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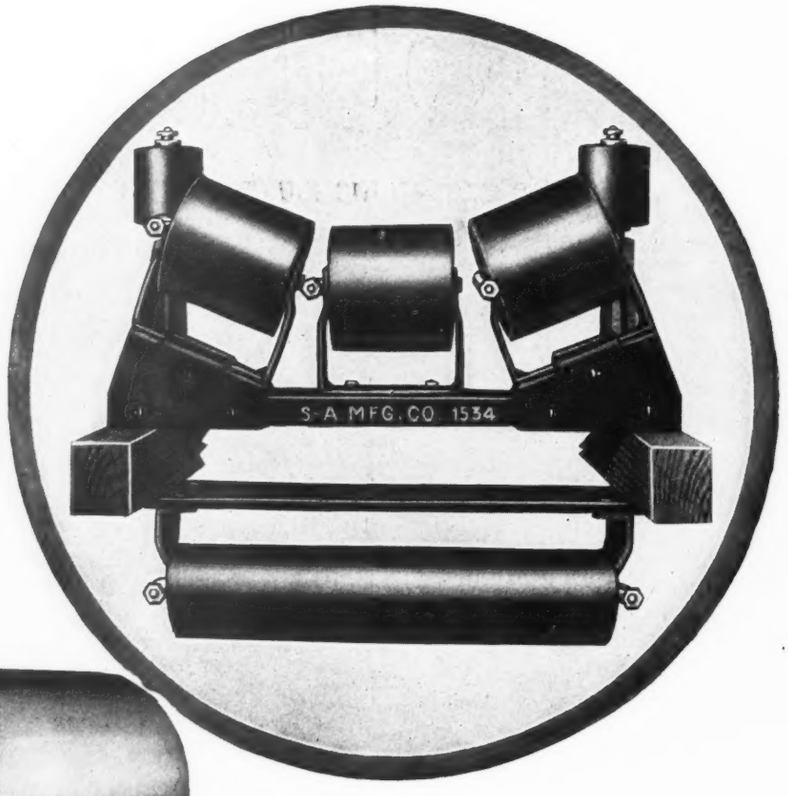

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ENGINEERING AND
MINING JOURNAL-PRESS

JOSIAH EDWARD SPURR, Editor

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Technical Efficiency and Co-operation

DUPLICATED RESEARCH in consequence of inadequate publicity is a serious drawback to technical advance. The mining and metallurgical industries in the English-speaking countries are suffering from a lack of co-operation, which, if practiced, would be of benefit to all concerned. These comments were prompted by noting the significant advances being made by mutual agreement between the chemical societies of Great Britain and the United States. Abstracting of chemical literature in all languages is facilitated by agreement between the American Chemical Society and the Society of Chemical Industry, whereby duplicated effort is avoided.

Early this year arrangements were made so that the *Journal of Physical Chemistry* could be offered at reduced rates to members of the leading chemical societies on both sides of the Atlantic. More recently it was announced that the American Chemical Society and the Chemical Society of London had entered into a co-operative agreement whereby members of the London society could purchase the journals of the American society, and the members of the American society could receive the journals and annual reports of the London society, at special rates in each case. This indicates that the chemist places the advance of his art above considerations of professional status or national preference.

It seems a matter for regret that no similar arrangement exists or is planned between the mining and metallurgical societies of the English-speaking world. Technical matter, as soon as published, is available to all by roundabout and exasperating methods. Instead of placing every obstacle in the way of those who are anxious to work efficiently, would it not be better to make arrangements whereby the member of one society could obtain automatically the publications of all other societies in which he might be interested, at a nominal rate? Nothing but good to all concerned would result from this procedure.

In our own particular branch of the mining and metallurgical industries each professional organization keeps strictly to itself in regard to the availability of published matter. Many of the papers published are of worldwide interest, yet it is impossible to keep in touch with developments of moment without going to the expense of membership. As soon as technical material is released its distribution should be facilitated in every direction in which interest in the subject is in evidence. The cost of the extra printing involved would be comparatively small, and it would be an excellent plan to take greater advantage of the extremely low international postage rates prevailing, which are only 1c. for each 2 oz. for this class of printed matter.

To take into consideration three of the important English-speaking societies—the American Institute, the London Institution, and the Mining and Metallurgical Society of America: The first is characterized by prodigality of publication and an almost entire absence of comment or discussion on the part of the rank and file of membership. The London society, with less money to spend, devotes most of its monthly bulletin to criticisms and contributed remarks; a recent issue of 59 pp. contains little else. The Mining and Metallurgical Society deals mostly with the economic and professional phases of mining, but its publications are so restricted in circulation that no adequate return for the work involved is possible under existing conditions. Membership in any one of these societies should permit the purchase, at nominal rates, of the publications of the other two.

Objections might be raised to a co-operative plan of this kind: Some engineers who could obtain transactions at a reduced rate would abstain from membership. Well and good; let the test stand. If membership in a professional society brings no greater advantage than opportunity to receive its publications, then it is clearly no more than a commercial effort on a par with the National Geographic Sociey, not a grouping of technicians for the good of the industry. Only special reasons can justify membership in foreign societies. But published matter should be easily available to all interested; and this, of course, should involve membership in one national society.

We suggest to the president of the London Institution that the subject of greater availability of published matter to members of sister societies be discussed at the forthcoming congress in London, at which all the principal engineering societies in the English-speaking world will be represented. We also suggest that steps be taken to formulate an international arrangement for the abstracting of technical literature in the mining and metallurgical industries, whereby the present system of duplicated effort and inefficient result may be replaced by one that will insure economy as well as service to the profession at large.

A California Opportunity; or the Underground Dredge

THE RESOURCEFULNESS of the promoter and salesman is endless. The game of giving a bonus with mining stock is an old one. Here comes a man (Arthur Hardt, 47 West 42d St., Room 432) who gives away mining shares as a bonus for buying a phonograph. You buy a $256 phonograph, reduced to $196, payable $5 down and $5 per month, with 6 per cent interest on unpaid balances. As a bonus you get "absolutely free of charge, a small interest in a rich and famous gold mine in California that has already produced about five million dollars." The unworked part of this mine is 100 acres of channel of an ancient river bed, which contains "probably more than $17,000,000 that can be mined at enormous profit with *an*

underground dredge, capable of handling from 3,000 to 5,000 cu.yd. of the gravel a day." The italics are ours. The *Scientific American* should rush to get the drawings for the underground dredge, which the gentleman who is promoting hopes to install "within a reasonable time"; but, he adds, cannily, "if we fail to get a dredge at work, there will be no profits for them to share." The bonus is "*nine-tenths of the profits on ten cubic yards of the gold-bearing gravel.*" Not much of a lure to a placer miner; but to an urban or bucolic goop it sounds like buying a chance on a ticket to Elysium. "Some of the gravel in that locality, I am informed, has produced as high as twenty thousand dollars a cubic yard. That would be the snug sum of $200,000 for ten cubic yards. Much of the gravel has yielded about $10 per cubic yard, but the average is much less than that. It costs only a few cents a yard to handle the gravel with a dredge."

Enough of the gold mine which you get with the phonograph. That is only one bonus. You also get another—a free and clear building lot, 35x200, "near the mines and on the Auburn Road, at Forest Hill, California." The charms and possibilities of this building lot, as set forth, are too varied and dazzling to be described. You can raise chickens, garden stuff, or fruit, seeds, or nursery stock, and ship them east to market. You may want to live on this little estate, 35x200. It costs more to stay at home and live in a cold climate, where you are troubled with colds or other dangerous winter diseases. Some people, the promoter suggests, go broke buying coal for the winter. (Is it a delusion, our recollection of walking through the deepest of snowbanks on the road between Colfax and Forest Hill, which passes this tropical resort?)

There are other chances to invest your money, if you have a little more. Mr. Hardt has 200 acres of timber land in California for which he has refused $6,000. He plans to organize a lumber company (The Readycut Lumber Co.) to dispose of the timber; then organize another company to develop the land into Bartlett Pear Orchards. He will give "a thirty-fifth interest in this lumber company, a similar interest in the land, or the proposed Orchard Company," and a four thousand dollar interest in the Bigdredge Mining Company, all for $1,000—and you can pay it at the rate of $10 down and $10 a month. With this will be thrown in a lot in the Forest Hill development scheme, 70x200 ft.

Diversification of investments, it is said, leads to safety; but there are exceptions to every rule. With land, pear orchards, gold mines, timber lots, and a phonograph, all to be bought for $5 or $10 down and $10 per, we can hardly keep from taking a flyer. Nevertheless, this is one of the things that should be investigated by the postal authorities, to determine whether the promoter would not be occupied to better advantage in jail.

Pressure, Temperature, and Speed Records

THE LOW EFFICIENCY of the average steam boiler has afforded a powerful stimulus for research; and efforts to displace it with something less wasteful of fuel have been unremitting. The vaporizing of mercury formed the basis of a recent development in this country that promised economies in several directions. More recently a non-boiling steam generator has been tested in England. It is the invention of Mr. M. Benson, and a radical increase in efficiency over standard apparatus is promised. Steam is produced at the critical temperature of water (about 706 deg. F.), involving the maintenance of a pressure of about 3,200 lb. per square inch, at which point the liquid is converted suddenly into vapor without change in volume, thus obviating need for the absorption of the customary amount of latent heat. The new invention makes possible the use of small tubes, previously found impracticable because of the impossibility of keeping the water in continuous contact with the metal, in consequence of ebullition.

In the first application of the new invention, the feed water is forced under high pressure into the bottom of narrow-bore, heavy-metal coils, which are heated in the usual manner. Before the water reaches the top of the coils the temperature has been raised to 706 deg. Direct conversion into steam takes place, no change in volume occurring during the transition from liquid to gas.

At the top of the coils the steam is superheated to 850 deg.; and an ultimate working pressure of 1,500 lb. per square inch is obtained by the provision of a reducing valve placed between the coils and the superheater. The steam is to be used to drive a turbine at about 20,000 r.p.m. It will have a pressure of 200 lb. on exhaust, after which it will pass to an ordinary condensing turbine, with vacuum.

Records in the achievement and application of temperature and pressure and speed, like piecrust, are apparently made to be broken. It is strange to realize that the system of thermometric measurement used in the evolution of the Benson steam generator was the one proposed by Fahrenheit in 1714, who believed that zero cold was reached by mixing snow with sal ammoniac. In 1763, James Watt made practicable the use of steam as economical motive power; but he was timid about pressures, at first developing no more than 7 lb. per square inch, the feed water being supplied to the boiler under hydrostatic head sufficient to overcome the steam pressure in the apparatus. Since that date development in this field has not been uniformly rapid, but great strides toward concentration of equipment and power have occurred in recent years. The customary steam pressure of about 350 lb. will be replaced by a working pressure of 1,500 lb. if the new invention proves commercially feasible. The speed of driven machinery has been accelerated tremendously since the perfection of efficient lubrication methods, the limit now being determined by the ability of the machine to hold together under the tremendous strains developed by centrifugal force. Here, metallurgical science has played its part.

However impracticable new inventions may appear to those accustomed to standard apparatus, it is stimulating to visualize the economies within the mental scope, if not yet within the actual grasp, of those bolder spirits who refuse to accept as final the existing records of temperature, pressure, and speed in current practice. The range of applicability of the Benson invention has yet to be determined, but it is safe to say that the realization of the aims of the sponsor of a non-boiling steam generator may revolutionize recognized practice and open up avenues for research on the problems of industrial heating and power generation. The mining industry is vitally interested in cheaper power.

Carbonaceous Gold Ore Treatment

RECENT METALLURGICAL DEVELOPMENTS at the treatment plant of the Ashanti Goldfields Corporation, in West Africa, are of significant moment to the company and of considerable interest to cyanide engineers. It may be recalled that the ore contains arsenic and graphitic carbon, the latter being the cause of a premature precipitation of a varying proportion of the gold dissolved during ordinary cyanide treatment. From 1909 until 1922 the ore was dried, ground, roasted, and then subjected to a simple bulk-leaching treatment. It is probable that, apart from effecting desirable changes in the chemical composition of the refractory elements, the roasting destroyed the colloidal nature of the finest material in the ore, thus permitting the even percolation of the leach solutions and making possible a total recovery of gold well over 90 per cent of the amount originally in the ore.

Early in 1922 radical changes were proposed and a new flow sheet was devised. Modifications were added from time to time, the final treatment including (1) crushing the raw, refractory ore in cyanide solution, thus bringing dissolved gold in contact with the graphitic carbon at the earliest possible moment; (2) the separation and separate treatment of sand and slime by routine methods of hydrometallurgical practice; and (3) the roasting and cyanide treatment of concentrate produced by Wilfley tables, a product that would contain little or none of the refractory carbon. Premature precipitation to the limit was anticipated, and steps were taken to neutralize the effect of this by the provision of what is known as a post treatment, with sodium sulphide.

To offset the complication involved, a much lower cost was anticipated, more than sufficient to counterbalance the lower extraction of gold that was considered inevitable. From recent reports, however, it is evident that the change was a disastrous one. Instead of an expected recovery of about 80 per cent, and in spite of two years' work and the elaboration of methods, the average has dropped to under 75 per cent. The company is now considering the advisability of reverting to the former practice of dry crushing, roasting, and bulk leaching, or of adopting a modification of this in the form of a combined treatment that will insure the isolation and roasting of the finer portion of the ore before cyaniding is begun. The problem is complicated by the scarcity of fuel and the increasing amount of refractory material in the lower levels of the mine.

The Ashanti company has had an extraordinarily prosperous career; dividends paid almost continuously since 1900 have averaged about 75 per cent per annum of the capitalization; the recent metallurgical fiasco, however, has put the property in the non-dividend class, temporarily it is thought. Reserves are estimated at over half a million tons containing gold worth well over $2,000,000. In fact, the richness of the property was doubtless one of the justifications for the changes in treatment made; at a low-grade mine every effort would have been concentrated on the possibility of avoiding radical alteration in the scheme of treatment.

Prevention is usually better than cure. The refractory portion of an ore, usually comparatively small in bulk, is best rendered harmless or isolated at the outset, or precautions taken that the cyanide treatment is prompt and so under easy control. The physics of the problem demands primary attention. Slime, especially if roasted, may sometimes be easily and efficiently treated in association with the coarser particles of a crushed ore, by bulk treatment; if isolated it may prove a serious bugbear to successful extraction. At Ashanti the raw, isolated slime was found to gelatinize in the presses. The inclusion of fine sand facilitated filtration but decreased the capacity of the plant for slime, part of which had to be run to waste, according to the 1923 report. Further, although early contact with cyanide solution may facilitate the solution of the gold, it also facilitates premature precipitation. The remedy, post treatment with sodium sulphide, is in our opinion not a simple instance of the dissolution of a gold-cyanogen compound in a solvent, as is assumed in the company reports. Unfortunately, it is impossible to judge, when cyanide solution containing gold is mixed with a gold ore containing a precipitant such as carbon, how much of the metal is dissolved and prematurely precipitated, and how much remains undissolved. Increased knowledge in colloidal chemistry prompts the suggestion that such abstraction of gold by carbon is an adsorption phenomenon, and that its re-solution is due to a disturbance of surface-tension equilibria. If this be so, the delicacy of the post treatment phase of operations must be recognized, and the advantage emphasized of avoiding premature precipitation in the first instance.

In studying the flow sheets of the various schemes of treatment at the plant in question one is struck by the tendency in evidence to depart from simplicity of operations. In some instances such a change is essential, but we wonder whether sufficient emphasis is generally paid to the fact that a metallurgical process that avoids the complex has a definite money-value advantage over another that is more complicated, although the latter may promise a higher technical efficiency or a greater net over-all economy.

Hands Across the Sea

THE FREEDOM with which technical information is released in America compared with the reticence exhibited by English and other European-controlled companies is again brought to mind by perusal of the May 10 issue of *The Mining Journal*, of London. The leading article is on tin smelting and refining in the United States, it being a reprint of a paper read before the American Institute of Mining and Metallurgical Engineers. The second leading article is a reprint of another A.I.M.E. paper, by W. H. Emmons. The third and only other technical article in the issue mentioned is a reprint of a paper on selective flotation by the Canadian Department of Mines. Why is it necessary to fill the magazine with reprints of American articles? Why will not English officials allow their own far-flung works to be described?

In editing the *Mining Journal-Press* we have found American companies and officials generally, with the notable exception of one important zinc company, free to tell us about what they are doing, that the information thus gathered may redound to the benefit of every one. But the companies with head offices in London are generally averse to all publicity. The American Smelting & Refining Co. has released much valuable information about the technology of tin in the United States. We think it is now up to the British smelters to tell us what they are doing.

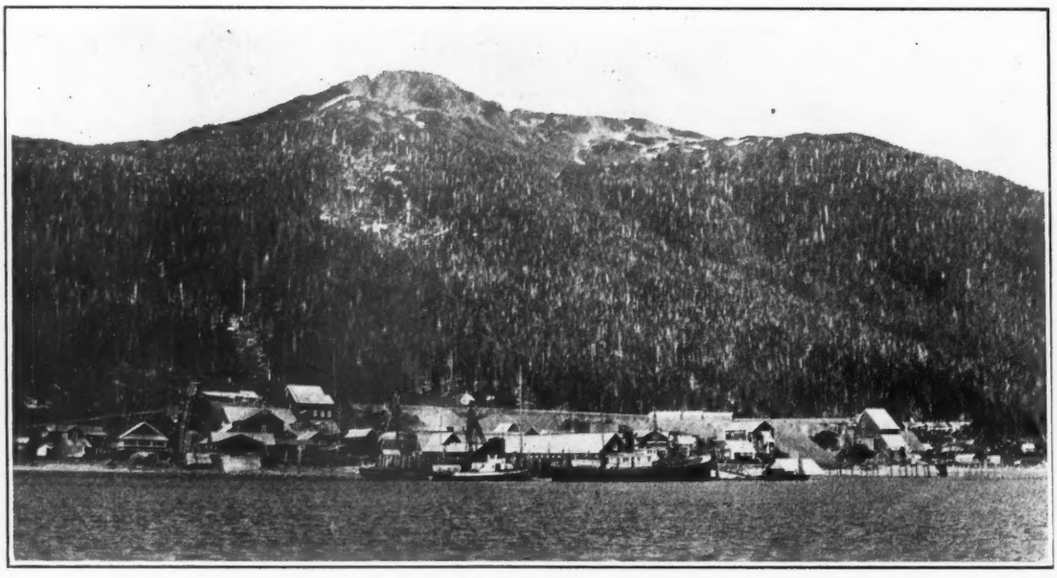
Mining and Milling Rich Gold Ore on Chichagof Island

Company Operating the Deposit Recovered Gold, Free but Finely Divided, by Amalgamation and Flotation Concentration — Shut Down in July, 1923, the Mine Recently Has Been Reopened

By H. N. Baumann, Jr.
Formerly Flotation-Plant Foreman, Chichagof, Alaska

THE CHICHAGOF GOLD MINE, during recent years the premier gold producer in Alaska, and among the important gold mines in the United States, closed down in July, 1923. The property has been sold to the Chichagof Development Co. This company plans to re-treat more than 200,000 tons of tailing stored on the beach near the mine and to mine the low-grade ore remaining as well as to prospect for new orebodies.

The mine is situated on Klag Bay, on the west coast of Chichagof Island, the most northwestern of the large islands of the Alexander Archipelago of southeastern Alaska. By boat it is 170 miles southwest of Juneau and 52 miles north of Sitka. The shore line of Chichagof Island is indented by a number of deep fiords and by numerous shallow bays and coves. Along its western shore there is a narrow coastal plain, consisting of rounded, timber-covered hills, rising above an area of swamps, ponds, and small lakes. Back of this, the greater part of the island is covered by rugged, steep mountains varying from 2,000 to 3,500 ft. in elevation. The mountains are covered with snow during most of the year.



Camp at the Chichagof mine

In the summer of 1905, Ralph Young and John Newell, Indian fishermen who had landed near the head of Klag Bay to obtain fresh water, noticed pieces of quartz containing free gold in the bed of the stream from which they were taking a drink. Young went to Sitka, and succeeded in interesting Judge Edward De Groff, a merchant of that city. Both went to Klag Bay, and by tracing the quartz float in the stream bed they found the quartz outcrop of the Chichagof mine, at an elevation of 275 ft. above the beach. Two mining claims were located and these became the property of the Chichagof Gold Mining Co., which was organized by Judge De Groff and his Indian associates.

When the news of the discovery of gold on Chichagof Island became known in Sitka in September, 1905, a stampede followed. The stampeders traveled from Sitka to Klag Bay in small boats, 16 miles of the distance being in the open ocean. Of the numerous claims later staked, the Golden Gate group was the most important.

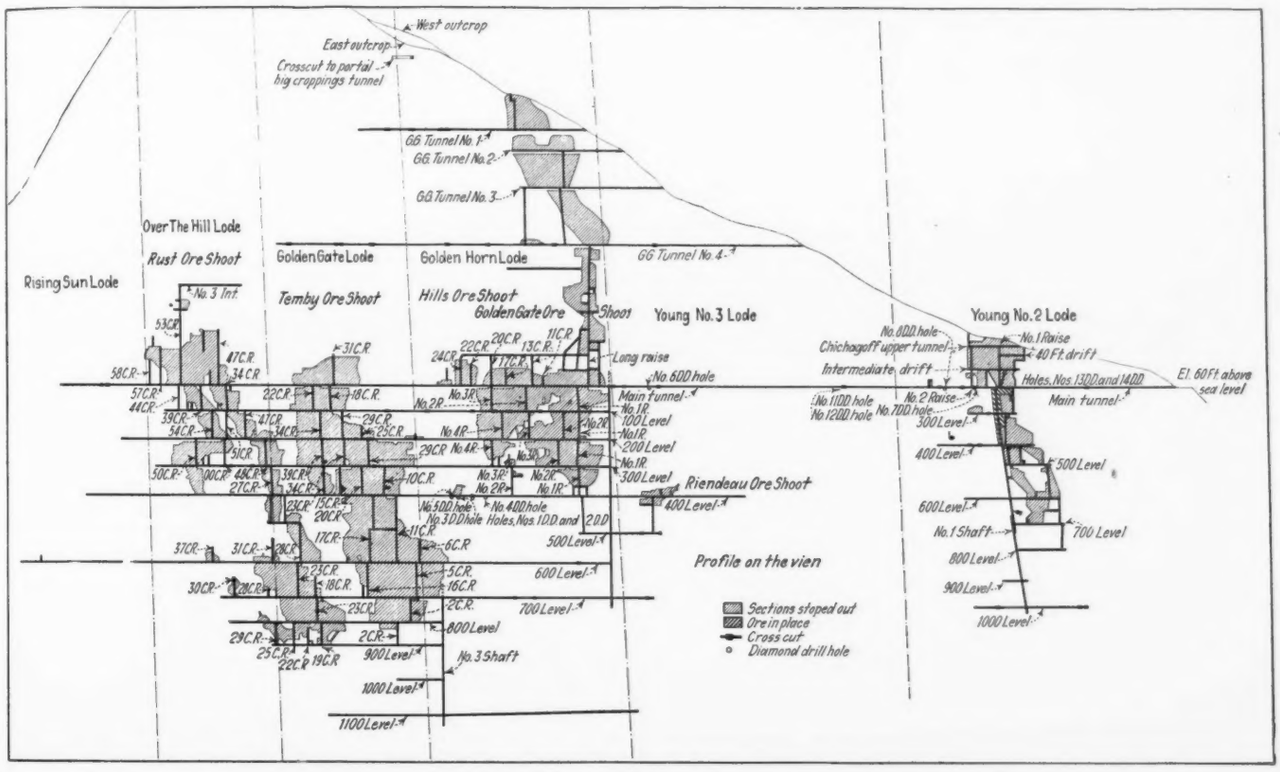
First Small Mill Not Profitable

The outcrop of the Chichagof mine was rich—so rich that the ore from it was sacked and shipped to the Tacoma smelter. The money thus obtained was sufficient to pay for the first equipment purchased. Development work exposed an orebody of fair size. The ore proved amenable to amalgamation and concentration. A small mill was installed, consisting of two triple-discharge two-stamp Hendy batteries, followed by a Lane slow-speed Chilean mill, amalgamation plates, and Wilfley concentrating tables. Despite favorable conditions and good-grade ore, the mine did not prove very profitable, principally on account of the limited mill capacity.

In 1909 James L. Freeburn examined the Chichagof mine, and upon his favorable report the Chichagof Mining Co. was organized and the property of the old company was taken over. The principal owners were Mrs. Lena De Groff, widow of Judge Edward De Groff, who retained an interest in the mine when the new company was formed; Hugh C. Wallace, former United States Ambassador to France; and W. R. Rust, for-

merly president and manager of the Tacoma smelter. In 1911, the Chichagof Mining Co. bought the property of the Golden Gate Mining Co. and subsequently acquired, by purchase or location, a number of other claims. W. R. Rust was president and managing director of the company and James L. Freeburn, general manager. William C. Freeburn was superintendent and F. A. Hill, chief engineer.

The Chichagof claims are located on the southwestern flank of Doolth Mountain, which is 2,100 ft. in elevation and stands on a peninsula projecting into the coastal plain. Being isolated in this way from the other mountains, Doolth Mountain is one of the prominent landmarks on the coast line.



Longitudinal section of the Chichagof mine, showing the extent of the working

Several members of the U. S. Geological Survey have described the geology of Chichagof Island. In the vicinity of the mine the geology is simple. Doolth Mountain consists of rocks belonging to a slate-graywacke series tentatively assigned to the Upper Jurassic. Near the mine the graywacke which predominates is an impure medium-grained sandstone, generally black or almost black on fresh fractures, but where exposed to the weather it is lighter in color. It is generally massive except where it grades into the slate; the bedding indicates a northwest strike and a dip to the southwest of about 72 deg. Several narrow dikes of diorite-aplite, conforming to the slate-graywacke formation, are found at a distance from the mine.

Vein Plainly Defined

The Chichagof ore is found in large tabular oreshoots. The vein occurs in a well-defined shear-zone conformable approximately with the country rock in dip and strike. The vein is accompanied throughout the length of the shear-zone by a well defined gouge. The argillitic graywacke that forms the walls of the mine has been altered in many places to the appearance of a black, lustrous slate, often slickensided. The plane of the vein is nearly at a right angle to the axis of Doolth Mountain. Where it intersects the summit of the mountain the crushed rocks of the shear-zone have been eroded more than the adjacent rocks, so that the apex of the vein is marked at that point by a prominent depression.

The oreshoots of the Young claims were the first to be mined and were largely worked out several years ago. The oreshoots of the Golden Gate claims were more extensive, both in value and size. The distance between the Chichagof oreshoots and the Golden Gate oreshoots is 1,760 ft. The Over-the-Hill claim is an extension of the Golden Gate group of claims and contained one large oreshoot.

Free-Milling Ore Containing Fine Gold

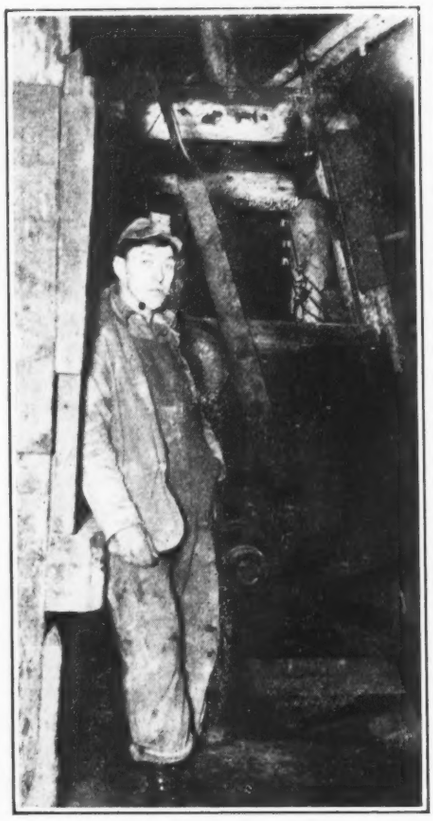
The ore occurs frequently as black and white "ribbon quartz," consisting of alternate layers of white quartz and black, graphitic graywacke. In other places the quartz is granular and free from graphite and graywacke. The ore is free-milling, but specimens having free gold visible are rare. Pyrite is the chief metallic mineral. Galena is present in much smaller amounts, but the presence of galena was taken as a sure indication of high gold content.

The mine is opened up by means of several adits. The principal adit, the portal of which is 70 ft. above tidewater and 250 ft. back from the beach, begins near the Chichagof mill and crosscuts the formation for several hundred feet until it reaches the vein, which it then follows as a drift for several thousand feet into the mountain. During the early days of the mine the ore from the upper workings was sent to the Golden Gate mill by a wire-rope tram. Except for this ore,

which was only a small part of the whole, the development and exploitation of the mine was carried on through the main adit.

The ore above the adit level was drawn into cars directly from chutes. That from below the adit level on the original Chichagof claims was raised through a single-compartment shaft, called No. 1 shaft, which was abandoned several years ago. The Golden Gate oreshoots below the main adit level were opened by No. 2 shaft, which is a double-compartment 72-deg. incline to the 700 level. One compartment was used for air and water pipes and a manway; the other was for the hoisting.

The hoisting equipment consisted of a Lidgerwood compressed air hoist and a one-ton skip. No. 3 shaft was sunk from the 700 level to the 1,100 level. The levels were spaced irregularly, but averaged 125 ft. apart.



Skip at bottom of the underground shaft

The ore was extracted by overhand stoping, most of the stopes being timbered. Where the stopes were narrow, the waste was blasted first and used for filling; the stope floor was then covered and the ore broken down and transferred to cribbed chutes. The wider oreshoots were timbered with square sets. The bonanza ore of the mine occurred in the Temby oreshoot (one of the Golden Gate oreshoots) between the 400 and 600 levels. Here the orebody was 12 to 14 ft. in width and averaged about $125 per ton.

Several types of Ingersoll-Rand and Sullivan drills were used, CC11 stopers in stoping and raising and jackhammers in sinking. The Ingersoll-Rand 248 water Leyner drill was used in drifting, as well as piston drills. The steel was sharpened on an Ingersoll-Rand Leyner sharpener. In the drifts and larger stopes round timbers were used; the narrower stopes were timbered with square timbers sawed in the company's sawmill. Split lagging was used originally in the stopes, but later sawed lagging was used. Except the timber in the shafts, which is fir, native spruce timber was used. Good spruce, fit for mine timbers, is scarce, although the whole adjacent country is timbered with inferior timber, chiefly hemlock and yellow cedar, which splits on taking weight. It was necessary to bring raft logs by water for distances of 50 miles or more.

The company owns two stamp mills; the larger, called the Chichagof mill, contains twenty stamps and a tube mill for regrinding. It has a capacity of 100 tons per day. The ore was transported through the main adit by mule train and dumped into a 15-ton crusher bin. After passing through a Blake jaw crusher it was discharged by a bucket elevator into a 300-ton ore bin.

There are four standard-type, five-stamp batteries, equipped with Challenge feeders. The stamps were operated at a 7-in. drop and a 4-in. height discharge. The battery screens were diagonal-slot, 16-mesh punched screens. Sea water was used throughout the mill.

All amalgamation was effected by silver-plated copper amalgamating plates. These plates were dressed every three hours, and care and skill with this detail was necessary for good extraction. After hanging up a battery and washing the sand from the plates, dressing the plates consisted in sweeping the surface of the plate toward the lip of the mortar with a whiskbroom, removing the loose amalgam, and adding the necessary quicksilver, which was thoroughly worked in. From the battery plates the pulp stream, which contained 25 per cent of solids, passed through two amalgam traps placed in series with each plate.

Amalgamation; Table Concentration; Flotation

The pulp was then separated into sands and slimes by a Dorr duplex classifier, in which additional water was added to the pulp. The sand went directly to the tube mill, and the slime overflow to the foot of a second Dorr duplex classifier operating in closed circuit with the 5x12-ft. Chalmers & Williams pebble mill. The overflow from the lower classifier averaged over 70 per cent minus-200-mesh material, all of it passing a 60-mesh screen. The classifier overflow was lifted by a bucket elevator to two Callow cones, the spigot product being received upon five "slime" amalgamating plates, which were dressed every three hours in the same way and with the same care as the battery plates. The battery and "slime" amalgamating plates recovered between 85 and 90 per cent of the gold contained in the mill heads; the actual recovery varied with the grade of the ore and the amount of graphite in the ore.

The overflow from the Callow cones was usually clear and was sent to the tailing pile. The pulp from the "slime" plates was distributed to ten Deister No. 3 slime concentrators. The concentrates recovered were stored for shipment to the Tacoma smelter and the tailing from the concentrators was sent to the flotation plant. The total mill extraction averaged always over 90 per cent and for months at a time was as high as 94 per cent.

The tailing from the Deister tables was elevated by a bucket elevator to a 30-ft. Dorr thickner. The feed to the thickener averaged less than 18 per cent solids and a thickener product containing 35 per cent solids was delivered to the head of the flotation machine. The overflow, although not always clear, was run to waste.

The flotation plant was installed by the Minerals Separation Co., but several radical changes and addi-

tions were made in the original plant. The pulp was first treated in a ten-cell M. S. machine, the first two cells being used for mixing, the next two making a finished concentrate, and the last six cells an intermediate product. Two Callow-type rougher cells were used in series with the M. S. machine and made an intermediate product and tailing. The intermediate product was passed over a Wilfley table, which made clean concentrate. The Wilfley tailing was elevated by a centrifugal pump to a Callow type cleaner-cell, which also made a final concentrate. The flotation concentrate laundered to two Callow cones and a small Dorr thickener which supplied a 3x4-ft. Oliver filter. The filter concentrate and Wilfley concentrate were mixed in bins and stored until shipped.

Concentrate Assayed $60 to $70 per Ton

All flotation oil was added at the head of the machine. A mixture of two parts coal tar and one part coal tar creosote was used as a collector and pine oil (crude wood creosote) as a frother. About one pound of the coal-tar mixture was used per ton of ore treated, the frothing oil being added at the rate of twenty drops per minute. The flotation plant during the last two years of operation under the former management made an extraction of 60 per cent and the concentrate assayed from $60 to $70 per ton.

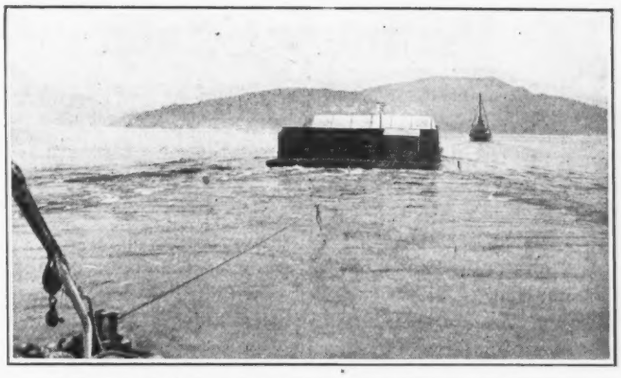
The Golden Gate mill is equipped with two five-stamp batteries and the same flow sheet as the Chichagof mill is used. Ore from the Over-the-Hill claim was treated in this mill.

The power for operating all machinery was generated by a 750-kw. hydro-electric plant 4.5 miles from the camp. Three Ingersoll-Rand type-10 air compressors furnished air for mining, hoisting, and other purposes. Steam was generated in a boiler plant for heating purposes, fuel oil being used.

The company operated a well-stocked store, a boarding house, and a well-equipped hospital. Three rooming houses, with well-lighted rooms, steam heated; a large club room, a large concrete dry room, with shower baths and laundry tubs, and a number of cottages for families were provided.

A motor ship, the "Ambassador," made regular trips to Juneau carrying mail, passengers, and supplies. Several times each year the "Ambassador" towed a 700-ton scow, the "Golden Gate," loaded with concentrates, to the Tacoma smelter and returned with fuel oil, lumber, and other supplies.

Temby stope—the bonanza of the mine



Scow "Golden Gate" on which concentrates are hauled to Tacoma

The Chichagof mine produced 385,900 tons; the gross production was $11,660,000 and the ore averaged $30 per ton prior to shutting down in July, 1923.

Production of Natural Sodium Compounds and Borates Rose in 1923

The production of natural sodium compounds in the United States in 1923 amounted to 59,440 short tons, valued at $1,775,940, according to a statement compiled from reports made by producers to the U. S. Geological Survey. These figures show an increase of about 31 per cent in quantity and 25 per cent in value over those for 1922. The materials marketed were sodium carbonate (soda ash) and sodium bicarbonate from Cartago and Keeler, Inyo County, Calif.; hydrated sodium carbonate (sal soda) from Green River, Sweetwater County, Wyo.; sodium sulphate (salt cake) from McKittrick, Kern County, Calif.; hydrated sodium sulphate (Glauber's salt) from Casper, Natrona County, Wyo.; sodium borate (borax) from Trona, San Bernardino County, Calif.; and trona (a double salt of sodium carbonate and sodium bicarbonate) from Cartago and Keeler, Inyo County, and Trona, San Bernardino County, Calif. The output of trona in 1923 amounted to 13,110 tons, valued at $114,190. This quantity was about 7 per cent less than that produced in 1922.

The output of boron minerals in 1923 amounted to 129,400 short tons, valued at $3,988,770 at the point of shipment, an increase of 52 per cent in quantity and 47 per cent in value over the output in 1922. The minerals produced were borax (sodium borate) from Trona, San Bernardino County, Calif., and colemanite (calcium borate) from Death Valley Junction, Inyo County, and Lang, Los Angeles County, Calif., and from Las Vegas and Moapa, Clark County, Nev.

It is reported that the exploitation of deposits of sodium salts may soon be undertaken at Clarkdale, Yavapai County, Ariz. (sodium sulphate); Owens Lake near Lone Pine, Inyo County, Calif. (sodium carbonate); Westend, San Bernardino County, Calif. (borax); Muroc, Kern County, Calif. (sodium sulphate); Shonkin Sag, Chouteau County, Mont. (sodium sulphate); Wabuska, Lyon County, Nev. (sodium sulphate); and near Alamagorda, Dona Ana County, N. M. (sodium sulphate).

Primary Chalcocite at Cananea, Mexico

A Discussion of the Genesis of an Important Copper Mineral

By Graham John Mitchell
Chief Geologist, Cananea Consolidated Copper Co.,
Cananea, Sonora, Mexico

IT IS DOUBTFUL if any mineral has aroused more technical discussion than the copper sulphide chalcocite, the genesis of which has long been a subject for scientific controversy, some investigators maintaining that the mineral is invariably secondary, whereas others believe it may also be of primary origin. This difference of opinion centers on the massive material alone, few, if any, doubting the secondary nature of the black powdery substance known as sooty chalcocite. This problem of genesis is one not of technical interest alone but of the utmost practical value, its solution having a significant bearing on copper-mine development. Realizing this, a group of American copper companies financed what was known as the Secondary Enrichment Commission, which had as one of its objectives the attempt to determine the genesis of chalcocite. But, though the problem has been approached from numerous angles—from the chemical, the mineralogical, the structural (as revealed in the field and by the microscope) and the physiographic—none of the investigations has proved conclusively that a primary origin may not be tenable in some instances. Thus the subject has been left open to further search for critical data.

Mineral Occurs in a Contact Zone

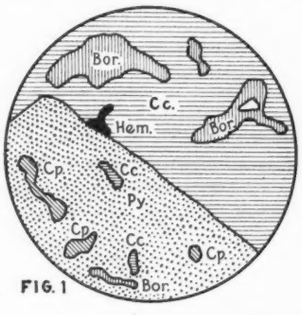
While studying the ore occurrence in the Capote mine, at Cananea, I have found chalcocite which gives every evidence of being primary in origin. The upper levels of this mine, for example, the "Bonanza orebody," produced a high-grade material, which, as noted by Dr. L. D. Ricketts, at that time general manager of the Cananea Consolidated Copper Co., consisted of a massive bed of chalcocite. This ore has been mined, but specimens in the company's geological collection show massive and sooty chalcocite. Subsequent sinking of the Capote 15 shaft to the 1,400 level has proved the presence of massive chalcocite to a vertical depth of over 1,300 ft.

The mineral occurs with other sulphides in a steeply dipping contact zone between monzonite porphyry and granite. The rocks in the immediate vicinity of the contact are crushed and fractured, due in part to pre-mineral faulting and also to the monzonite intrusion, which has included dislodged blocks of granite. Prospecting has not progressed far enough to determine the full extent and intensity of mineralization, although enough work has been done to disclose the mode of occurrence and mineral association of the copper sulphide and to afford material for microscopic study.

The major structural feature involved is a contact zone dipping 75 deg. to 85 deg. northeasterly and striking N. 20 deg. W. The width and horizontal and vertical extent of this zone is at present undetermined; however, it is not related structurally to any known orebody in this mine. The hanging wall is monzonite porphyry with quartz monzonite phases; the footwall is granite.

The monzonite is light gray in color, with plagioclase feldspar and an occasional biotite flake as phenocrysts. In some specimens quartz is also present, indicating a quartz-monzonite phase of the rock. In thin sections the determinable plagioclase is andesine, with alteration to sericite and calcite.

The abundance of sericite is in fact a most striking feature of the rock. Where quartz is present as phenocrysts, the borders of this mineral are nearly always corroded, giving it a rounded appearance. The mica phenocrysts are biotite. The groundmass is composed of fine-grained interlocking crystals of plagioclase and orthoclase, with quartz present in the quartz monzonite.



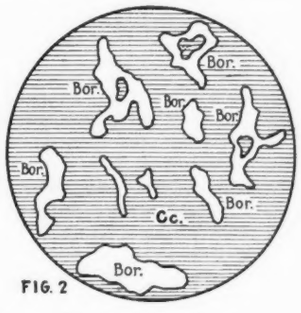


Fig. 1—Py. = Pyrite; Cc. = Chalcocite; Bor. = Bornite; Cp. = Chalcopyrite; Hem. = Hematite.
Fig. 2—Cc. = Chalcocite; Bor. = Bornite.

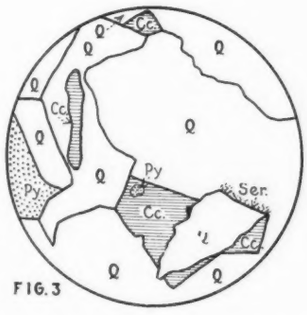
Slender prisms and basal sections of apatite occur as well as three sections of zircon, two of which are inclosed by quartz phenocrysts. The granite is coarse grained, with feldspar and quartz as the prominent minerals. The feldspar phenocrysts, chiefly orthoclase and microcline, and sometimes three-quarters of an inch to one inch in their longest dimension. In some specimens quartz is strongly developed and the feldspars are less prominent.

"Floating Inclusions" Noted

The minerals in the contact zone, in the relative order of their abundance, are quartz, pyrite, chalcocite, sphalerite, galena, bornite, chalcopyrite, hematite, magnetite, siderite, and molybdenite. Specimens of the mineralized rock are characterized by a massive interlocking habit of the minerals, quartz, pyrite, chalcocite, and sphalerite exhibiting this feature to a marked degree. Alteration, such as accompanies the action of surface waters on material of this character, is noticeably absent. Small quartz-lined vugs are present in which chalcocite, sphalerite, and pyrite are packed in between the crystal faces of quartz. In one of these cavities small siderite rhombohedrons have grown on the surface of the quartz, and in another slender prisms of quartz project from the faces of a pyrite cube. Fragments of the monzonite hanging wall are included in the mineralized zone, occurring in such a manner as to suggest what J. E. Spurr calls "floating inclusions."[1]

Microscopic examination of polished surfaces dis-

[1]Spurr, J. E. "The Filling of Fissure Veins," *E. & M. J.-P.* Aug. 25, 1923, p. 329.


Q
Cc.
Py
Ser.
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Q
Cc.
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Dana.[3] They are built upon a basement of intercrystallized chalcocite, quartz and pyrite, the walls of the cavity which they occupy also being made up of these minerals. The crystals show the *m*, *b*, *p*, *d* and *c* faces with *c* striated parallel to edge *b-c*. A qualitative analysis of the cluster of two gave only copper and sulphur present, with no trace of silver, lead, antimony, mercury, bismuth, tin, nickel, or cobalt. Fig. 9 is a photograph of the larger group of crystals and shows the pseudo-hexagonal symmetry.

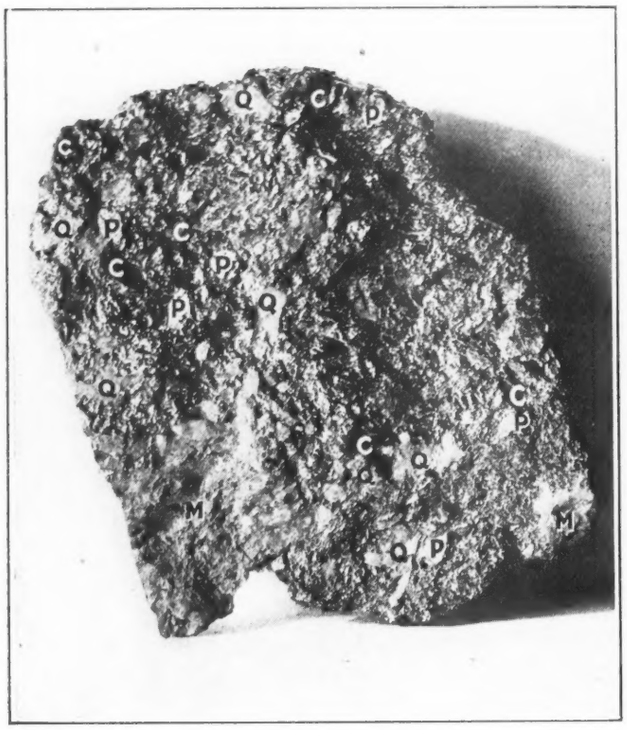


Fig. 10—Intercrystallized quartz (Q), pyrite (P) and chalcocite (C). Light gray in lower left hand corner is an angular inclusion of quartz monzonite (M).

Crystallized chalcocite is not of common occurrence, Cornwall and Bristol being the noted localities where it has been found. This is the first instance, to my knowledge, of its occurrence in Mexico. The primary nature of the pyrite, quartz, and chalcocite with which the chalcocite crystals are so closely associated leaves little room to doubt the primary character of the latter. This would mean that primary chalcocite does form in nature at a temperature below 91 deg. C., the temperature above which the orthorhombic form is not stable.

Where descending surface waters have developed chalcocite in pyritic copper ore, sericite, if present, is changed by sulphuric acid to kaolin. In the present study, unaltered sericite is found cutting across the boundaries of quartz and chalcocite. As previously noted, sericite is abundant in the inclosing rocks. If surface waters had been active to the extent of forming the chalcocite, one would expect kaolin as a prominent mineral. This, however, is not the case.

The paragenesis of the minerals shows quartz and pyrite as the first to form together, with a small amount of chalcocite, chalcopyrite, and bornite. The principal period of chalcocite deposition followed the earliest quartz, as did also the sphalerite. Pyrite, though one of the first sulphides crystallized, is also among the last, as shown by crystals of this mineral occupying small vugs. These crystals, as previously stated, have served as a foundation upon which siderite and quartz have been built, thus placing the iron carbonate and some quartz in the very latest period.

The presence of crystallized chalcocite in vugs also establishes a wide paragenetic range for this mineral in the occurrence under discussion. A genetic relation between the monzonitic intrusion and copper mineralization is supported by field studies and also by assays of a considerable area of this same rock mass at an equivalent depth below the surface, where over 1,000 ft. of diamond drill core averaged 0.5 per cent copper. It might also be noted here that monzonite and quartz monzonite are associated with the ore in other orebodies in the district.

[3]"The System of Mineralogy," p. 55, Fig. 4.

Potash in 1923

In 1923 the United States produced 39,029 short tons of crude potash salts, containing 20,215 short tons of K_2O, according to information furnished by the U. S. Geological Survey. Of this output 32,254 short tons of crude potash, containing 17,982 short tons of K_2O, was produced from mineral sources—natural brines and dust from cement mills and blast furnaces—and 6,775 short tons of crude potash, containing 2,233 short tons of K_2O, was produced from organic sources—molasses distillery waste and beet-sugar refinery water. This output was made by eight companies operating twelve plants in California, Indiana, Maryland, Nevada, and Pennsylvania.

Sales and stocks on hand were reported by several companies that produced no potash in 1923. The quantity sold, as reported by eight companies, operating eleven plants, amounted to 35,164 short tons of crude potash, containing 19,281 short tons of K_2O, and was valued at $784,671. The stocks on hand Dec. 31, 1923, as reported by ten companies, operating fourteen plants, amounted to 34,794 short tons of crude potash, containing 12,363 short tons of K_2O.

Imports of crude potash into the United States in 1923 amounted to 748,101 short tons, containing 209,581 short tons of K_2O, valued at $15,354,755, of which 95 per cent were salts used for fertilizer.

Don't Quench Steel with Lubricating Oil

Things can happen in an underground mine blacksmith shop that would be practically impossible in one on the surface.

At an eastern metal mine the blacksmith had requisitioned oil for quenching. Through error he received a container of oil intended for lubrication purposes. On coming on shift he proceeded to fill his quenching tank with what he believed to be the oil that he had asked for. As the first cherry-red bit was plunged into the oil, the liquid burst into flame and a cloud of dense smoke filled the shop and adjacent workings. The smith took time to give the fire signal before running to the shaft. Nothing burned but the tank of oil and the bench on which it rested. The engineer in charge of operations got all of his men out safely. And sometime that day the working was freed of smoke. But a day's production for the entire mine had been lost.

Restriction of Immigration

By T. A. Rickard

WE MINING ENGINEERS have expressed both a great regard and a great respect for our professional brother who is now the Italian Ambassador at Washington; therefore it seems to me that when he, Prince Caetani, calls our attention to the fact that many prejudices against his countrymen are proved to be unwarranted by the very statistics of the United States Bureau of Census, we should give friendly consideration to his statement. To substantiate his claims the Ambassador has sent to a few of his former associates in the mining industry a book, recently published, on "Some Aspects of the Italian Immigration to the United States," written by Dr. Antonio Stella, the well-known physician and student of immigration questions in New York. It deserves to be read and considered, for it is a good statement of the case, from the Italian side. Moreover, the question of immigration, like that of Americanization, which I discussed in these pages recently, is one that concerns the mining public, because, of course, upon the character of the workers available at the mines will depend, in large measure, the effectiveness, and therefore the economy, of operations. The Italian has proved himself a good miner in the United States, especially those who came to us in the earlier days of the West from the Val d'Aosta, in the northwestern corner of Piedmont, which has produced hard-rock miners of a fine type. Many of the men from northern Italy are experienced miners, and therefore are more immediately useful at our mines than the peasants of southern Italy; but the latter are quick witted and are capable of being taught, especially by a foreman able to speak Italian. The language question is one not to be disregarded, as I have said before; the first step in the Americanization of an alien is to acquire the speech of Americans. Let us now return to Dr. Stella's book.

In an introduction, Dr. Butler, the president of Columbia University, says: "Whether we regard the history of the Italian people or their contributions to letters, to science and to the arts, or their zeal for progress in these modern days, they must be placed in the front rank of the world's great powers. They would be so placed had they neither a battleship upon the sea nor a regiment of infantry under arms; they have gained that place by a display for centuries of intellectual and moral qualities which the whole world recognizes."

Dr. Butler makes another remark, less likely to be accepted with equanimity, but well worthy of thought, when he says: "It is simply not true that the greatest danger to American institutions comes from the immigrant class; it is just as likely to come from the unintelligent intellectuals of the native-born class."

This provocative dictum I shall pass without comment for fear of mental derailment from the purpose in hand. Dr. Stella is more disarming; at the outset he says: "There is ample justification for the adoption, recently made by the United States, of a policy of exclusion as to certain types of immigrants and of their limitation to a number that, in accordance with their assimilability and ethnic characteristics, can be absorbed by the nation in an adequate period of time." He then proceeds in his book to discuss the question whether the Italians belong to those "certain types" that are rightly excluded, and endeavors to prove that they are not to be so regarded. His evidence is mainly statistical.

In 1920 there were in the United States 1,610,109 Italians, of whom 28 per cent had become naturalized, whereas 65 per cent of the British and 72 per cent of the Germans had become naturalized; but, in the subsequent two years, 1921-1923, 10 per cent of the Italians had become naturalized, as compared with 6 per cent of the British and 7 per cent of the Germans. So it appears that the Italians are exhibiting an increasing tendency to political assimilation. Next, of the undesirable aliens deported in the last three years, the average per nationality has been 91 per annum, of whom an average of only 18 have been Italians, as against 168 French and 284 Spaniards. These figures evidently need further explanation.

Of the number of arrests for drunkenness and disorderly conduct per 100,000 of the various nationals, the American-born white stands at 202 and the negro at 425, as against 158 for the Italians, 488 for the English, 219 for the Germans, and 1,540 for the Irish! These figures are from the Tenth Census. In the matter of drunkenness of women, according to the same census, the rate per 100,000 is 4.39 for Italians, 85.10 for English, 13.38 for Germans, and 275.5 for the Irish. The only remark to be made here is to ask why Dr. Stella does not quote from the 1920 census; probably because these particular statistics are not yet available. As to prostitution, the ratio is 1.0 for Italians, 1.5 for Germans, 7.8 for English, and 8.3 for Irish.

Here I may note the fact that the Italians, at least in California, do not allow their unmarried daughters to go into domestic service; they maintain the excellent custom of keeping them under the parental roof until they have homes of their own. In hospitals for the insane, the ratio per 100,000 in 1910 was 168 American-born, 386 English and Welsh, 551 Germans, 974 Irish, and only 136 Italians.

Statistics for mortality confirm this testimony as to the good habits of the Italians, for the rate is the same as that of the American-born, but better than that of the other races. Moreover, in the states in which criminality is highest the Italian population is the lowest; the converse also holds true. Dr. Stella acknowledges that the Italians remit a considerable part of their earnings to their folk in Europe, but this he explains by the fact that the Italian immigrants are predominantly able-bodied men, whose families are still in Italy, and he argues that the money thus exported "returns in a large measure to the United States for the purchase of wheat, raw material, and other merchandise."

Such, summarized, is Dr. Stella's plea. He concludes with these words: "Italians have contributed beyond measure to the cultural life of the United States, in the musical and plastic arts, and in the development of the sciences. They constitute an important factor in the economic life of the United States and they represent one of the most valuable assets in the future of the

Nation." With this statement no fair-minded person will be inclined to quarrel, nor indeed with much else that Dr. Stella says; but unfortunately the whole argument suffers from the defect that no distinction is recognized between the two types of Italians, those from the north and those from the south. Until that is done the whole discussion is at cross purposes.

The northern Italians have, at least in former years, considered themselves superior to the southern people, and our legislators, there is reason to believe, hope, among other things, to exclude these southern Italians, although, of course, this purpose cannot be avowed openly in Congress. Yet it is hardly fair. The southern Italian, including the Sicilian, is poor and illiterate, largely because he comes from a region that is overpopulated. That is why the Italian Government encourages his immigration. The industrial status of southern Italy is low compared to the north, but these people have produced many great men, including a majority of the statesmen that have governed Italy under the forms of parliamentary governments. In California they are fishermen and truck gardeners, most efficient in these occupations, although commonly rated as unskilled labor.

The purpose of restricting Italian immigration is not to exclude the people of Italy so much as to exclude those of southern Italy. This, among other purposes, is the aim of the Johnson bill, which takes as its basis for a 2 per cent quota the census of 1890, when the number of Italians in this country was very small. How the Johnson bill would reduce the number of immigrants from Italy and other countries in southern and eastern Europe is shown by the following statistics:

	3 Per Cent Quota on 1910 Basis	2 Per Cent Quota on 1890 Basis
Italy	42,057	3,912
Russia	21,613	1,992
Poland	21,076	5,156

The aim also is to allow the admission of a relatively large proportion of immigrants from Great Britain and other countries of western Europe from which has come the racial stock—vaguely termed Nordic—that is predominant in the American people. The Johnson bill will affect western Europe thus:

	3 Per Cent Quota on 1910 Basis	2 Per Cent Quota on 1890 Basis
Great Britain	77,342	62,458
Germany	67,458	51,227
Sweden	20,042	9,561
Norway	12,202	9,454

Under the 2 per cent of 1890 regulation only 168,837 immigrants from all countries would be admitted, as against 357,803 under the present law, which expires on June 30 next. A minimum quota of 400 is granted to each nation, under the Johnson bill; otherwise the Poles, Bulgarians, and Spaniards, for example, would be completely shut out. It is provided that arrangements shall be made for certification of fitness by a United States consul, so as to stop ineligible persons from making a useless voyage to Ellis Island. The idea is excellent, but to what extent the consuls are qualified and willing to discharge this duty efficiently may well be doubted. It is worthy of a trial, however, even if new officials have to be appointed for the purpose.

The immigration from southern and eastern Europe may be said to have begun as late as 1871, for not until that year did it reach a total of 10,000; in 1896 this new immigration exceeded that from northern and western Europe; and every year since then an excess has prevailed. In 1914 the high mark of immigration was reached, with 1,218,480 arrivals, and in that year 71 per cent came from the countries of southern and eastern Europe, as against only 13.6 per cent from northern and western Europe. In 1921 the ratios were 64.7 and 17.8 in a total of 805,228.

The law restricting immigration on the basis of a 3 per cent quota was passed on June 3, 1921, by which time 5,000,000 unemployed called for remedial action on the part of Congress. No numerical restriction applies to those coming from our neighboring countries in America save proof of residence in one of those countries for five years. Under the existing law, the entries in 1923 were 522,919, of which 29 per cent was from southern and eastern Europe, and 30 per cent from northern and western Europe, together with 22 per cent from Canada and 15 per cent from the American countries south of the United States.

The rate at which aliens assimilate is indicated by the statistics of naturalization: today out of 14,000,000 white aliens, less than half are naturalized, and the census shows that on the average they allow ten years to pass after their arrival before acquiring the status of citizenship. The best record is that of the Welsh, of whom 74.4 are naturalized, compared with 73.6 per cent Germans, 70 per cent Scandinavians, and 62 to 66 per cent for the Irish, English, Scottish, and Canadians. The poorest record is that of the Greeks, Bulgarians, Spaniards, and Mexicans, who range from 17 to 5.5 per cent, the worst being the Mexicans. Undoubtedly the difficulty of learning our language is one that affects these statistics, for it favors the British, and even the Germans, whose language is akin to ours, as compared with the people of the so-called Latin races.

The Secretary of Labor, James J. Davis, himself once a Welsh immigrant, favors restriction and selection, but like many others he aims to prevent a "conglomeration of racial groups, each advocating a different set of ideas and ideals according to their bringing up." That, I submit, is an example of over-statement, for even those of native stock have ideas and ideals that differ according to their breeding and education, which varies greatly, and will continue to vary.

The notion of making the American people homogeneously "Anglo-Saxon" in the old sense is no longer practicable; we have to take our people as they are, of many racial strains, and endeavor to restrict the introduction of new elements to such as will most readily assimilate with us, but not without bringing to us their ideals and ideas, especially in art and literature and in all that makes life interesting and fruitful. To the present writer it seems desirable that religious and racial prejudices should be set aside as criteria for exclusion, because neither race nor religion prevents a man or woman from becoming a good American. What is needed is a selection based on morality and intelligence, to be ascertained at or near the port of departure. A responsible and intelligent Italian or Serb, even if poor and unable to speak English, is preferable to an irresponsible and unintelligent Briton or Scandinavian, even if he can speak the language of the United States.

The alien will soon learn the speech of his new country if he is intelligent; on the other hand, his failure to do so argues either stupidity or lack of a desire to assimilate; in which event he might be invited to return to the place of his origin. This is a test that ought to be included in any new law.

Electrometer Tests in Flotation

Simple Experiments Indicate Advisability of Further Work on Electrostatic Charges

By T. M. Bains, Jr.
Assistant Professor of Mining, University of Illinois

T. M. Bains, Jr.

IN DECEMBER, 1868, experiments were started at the University of Glasgow on the electrification of air, but no decisive results were published. In July, 1894, further extensive experiments were conducted by Lord Kelvin and other noted physicists.[1] The results of these experiments clearly demonstrate that whenever air is blown through water the air receives an electrical charge. The results of the experiments of Sir J. J. Thomson, in electrifying air by means of dropping water through it, or by splashing of liquids,[2] also proved that air is thus given a charge. One of his statements is that "one of the most effectual ways of charging a gas with electricity is by means of the splashing of liquids." Notwithstanding that these experiments by the leading physicists of the world were conducted in the last century, before flotation of ores was brought to the attention of the mining profession, there is nothing in the literature to date to show that any similar experiment has been tried in the study of flotation.

I started some experiments similar to Lord Kelvin's, but used a small aëration cell of the Callow type, instead of a bellows and glass tube. In Fig. 1, the apparatus used for these experiments is shown. A Lord Kelvin electrometer was suspended on a wooden base, by means of three copper wires. All wires, metal parts, and the casing of the electrometer were grounded, and the apparatus was screened from outside static influences. The reading scale was one of the ordinary scales used for such purposes. The divisions on the scale were reflected by the suspended mirror of the electrometer, so that by looking through the telescope, shown under the scale, accurate readings could be made. The electrometer had a platinized suspension and therefore the needle could be charged from an external source. Dry cells were used for this purpose, and during the tests 2.6 divisions on the scale equaled one volt. As the scale was graduated to twenty-four divisions on either side of the zero, almost ten-volt deflections, either plus or minus, could be read. By changing the voltage applied to the needle of the electrometer, its sensitiveness could be varied over a wide range. A platinum wire connected the insulated quadrants of the electrometer to the liquid in the flotation cell. Readings therefore were of the electrification of the liquid, not of the gas. But as the amount of electrification of the gas is equal to that of the charge left in the liquid, only the sign of the charge is affected. It is difficult to measure the charge on the gas directly; this is where most of the failures have occurred in detecting charges on bubbles.

The cell was made by inserting canvas disks between the parts of a 2-in. union coupling, instead of the ordinary rubber gasket. A glass tube was fitted into the upper end of the union; the lower end was fitted with a bushing, nipple, and flexible metal tube. This metal tube was insulated from the ground by a shellac tube, as shown in Fig. 1. The apparatus was placed on a ring stand the legs of which were heavily insulated by shellac cones and plates of mica. Air from a compressor was passed through a drier of calcium chloride before entering the shellac tube. Any electrification therefore was registered on the electrometer scale.

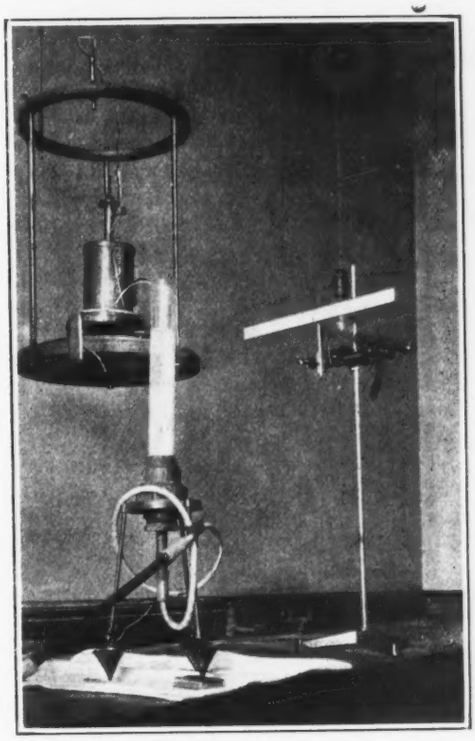


Fig. 1—Apparatus used in electrometer tests

The curves shown in Fig. 2 are from tests made with ordinary tap water and compressed air, with the addition of alpha naphthylamine later. The first curve shows a slight positive electrification when the air was turned on and then a very rapid negative electrification, so that within two minutes the voltage was off the scale or over ten volts. With the air off, the

[1] *Philosophic Magazine:* "Electrification of Air and Other Gases by Bubbling Through Water and Other Liquids," by Lord Kelvin. February, 1895.

[2] "Discharge of Electricity Through Gases," by Sir J. J. Thomson. 1898.

"leakage" curve of the apparatus is shown; this depends on the climatic conditions. One gram of pulverized pyrite was added. The peculiar action when the air was turned on again is interesting. The reading went off the scale in four minutes. The leakage curve was similar to the first.

The addition of one drop of alpha naphthylamine, or A.T. compound, in 200 c.c. of water shows remarkable results. It prevented the building up of voltage above four volts, and when the froth concentrate was discharged from the top of the cell into an insulated vessel, this feature disappeared, as the reading went off the scale when the air was again turned on. This

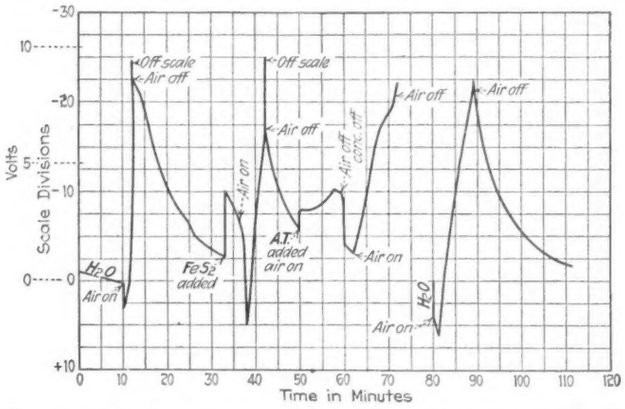


Fig. 2—Results of test with water and compressed air

seems to indicate that most of the A.T. compound went off with the sulphides, as is true. There was enough effect from the remainder, however, to slow up the electrification, it taking ten minutes to reach twenty-four divisions.

The next curve shows the effect of the minute quantity of A.T. compound. The old charge of pulp was thrown out and the tube thoroughly washed with cold water. New tap water was added and the electrification was twenty-two divisions in eight minutes, enough of the A.T. compound still remaining after a cold water wash to affect the test.

In Fig. 3, the curves cover a three-hour test. This curve illustrates the necessity of using a uniform pressure of air during the test. The first electrification was extremely rapid, the air pressure being very strong. The cell was grounded to take off this charge rapidly, and then a weaker pressure was applied. The electrification was only one-tenth as rapid. An increase in pressure in the next curve shows a more rapid electrification, but only one-sixth of the first. The rest of the curves are at this third pressure. The effect of a drop of eucalyptus oil is shown. This does not prevent rapid electrification, as does the A.T. compound. The effect of an oxidizing reagent, as nitric acid, is interesting, one drop reversing the electrification. This checks the results of Sir J. J. Thomson's experiments on oxidizing reagents. The addition of hydrochloric acid had little effect, and A.T. compound had about the same dampening effect as before. However, when a gram of pyrite was added, different results from those shown in Fig. 2 were secured, there being a gradual electrification to twenty-one divisions, and only with the shutting off the air was this stopped.

These experiments are brought to the attention of the profession, as there seems to be field for research here. In the new textbook on ore dressing by S. J. Truscott, professor of mining at the Royal School of Mines, a most excellent treatise by the way, he gives credit to the part that electrostatic phenomena play in flotation: "That electrostatic charges contribute to the functioning of the process is, however, certain from the profound effect which the smallest amount of electrolyte, of colloid, or of gas, can have upon the result. The addition of acid has sometimes and almost miraculously secured a mineral froth when neutral and alkaline circuits have both failed; a trace of a negative colloid, such as glue, saponine, tannine, etc., has sometimes hopelessly destroyed all tendency of the mineral to rise; a whiff of sulphur dioxide in the air has sometimes caused the froth to collapse and disappear."

Although he gives greater credit to interfacial tensions, he emphasizes the effects of electrostatic forces. "Armored bubbles" depend on the finer particles and these bubbles are the essential ones in flotation, it being very difficult to float closely sized grains. The remarkable phenomena produced by extremely small amounts of coal-tar derivatives and other reagents not classified as oils are more dependent on the electrostatic than on the interfacial tensions, unless one is willing to consider these interfacial tensions as electrostatic also.

Prof. Charles Y. Clayton and associates at Rolla made some experiments relating to the dielectric constants of oils and reagents and their relation to the flotation of galena.[3] He summarizes the results as follows: "The following data indicate that of all the oils tested, those with high dielectric constants gave the best results." There were two exceptions, oil of orange and oil of lemon. The former gave the cleanest of concentrates.

Prof. Jacob Kunz, of the department of physics at the University of Illinois, in a lecture recently delivered before the American Chemical Society on "The Significance of the Dielectric Constant in Chemistry," brought out that substances with large dielectric constants give rise to electrolytic dissociation, to hydration of ions, and to condensation in general.

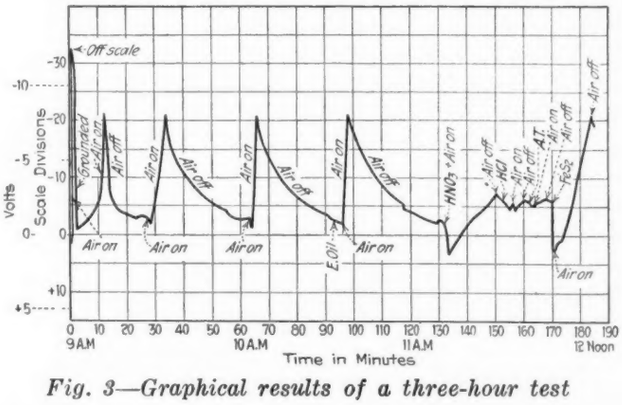


Fig. 3—Graphical results of a three-hour test

A great number of tests with various oils, reagents, and minerals will be required, however, to obtain sufficient data to determine if the electrometer method of testing is of practical value. With the introduction of Truscott's "Textbook of Ore Dressing" in the mining schools of the country, more interest should be taken in this side of flotation. The U. S. Bureau of Mines is spending much time in research in regard to interfacial tensions, but has had little to say on the electrostatic side of the problem.

[3] "Dielectric Constants and Flotation Values of Oils." *Met. & Chem. Eng.*, Nov. 1, 1916, p. 504.

What Is Your Program of Thrift Promotion?

Some Practical Suggestions for Operators

By Fred. H. Rindge, Jr.
Secretary, Y.M.C.A. Industrial Service Movement, New York City

INCULCATING HABITS OF THRIFT makes for industrial stability, prosperity, and contentment. This is an all-year-round program! Management has long promoted safety campaigns. Thrift is economic safety, and as such is equally important.

Every industry should promote among its employees the idea of wise earning, saving, buying, investing, and giving. Occasional mass meetings at noon hour, special motion pictures, stereopticon lectures, exhibits, thrift leaflets in the pay envelopes, plays, pageants, savings clubs, and the like, where practicable, are all decidedly worth while. Thrift stories and cartoons should be placed in plant papers, trade publications and organization bulletins. (Material can be secured from the Y.M.C.A. National Thrift Committee, 347 Madison Avenue, New York City.) Local cartoonists and artists will often contribute their talent. Motion picture theatres are glad to show thrift slides and films.

"Use Time and Money Wisely"

Last year one city printed and distributed a million cards carrying the Ten Point Financial Creed. The slogan "Use Time and Money Wisely" should be used throughout the year. Too much time and money are wasted in the average mining town. Window displays form a most economical and effective method of advertising thrift. Local leaflets may be printed in various languages to reach employees speaking foreign languages.

"Own your own home" campaigns help employees to save, buy homes, and thereby become more stable and happy. Of course, there are some mining camps that are of such temporary nature that the idea of owning a home would appeal to but few. The thrifty man should spend only half his wage on general living, 10 per cent for education, 10 per cent for recreation, and 10 per cent for charity. This leaves a possible saving of 20 per cent!

Every Man Should Be a Capitalist

The way to abolish poverty and bolshevism is to make every man, as nearly as possible, a capitalist. That can only be done by *thrift*. Management must prove to the laborer that he should increase his earning power by making his saved-up money work for him. The inequalities of society, that some are rich and some are poor, can be cured, not by leveling down, but always by leveling up. The program of bolshevism would make everybody poor, by abolishing capitalism, which would be a step backward toward barbarism. But the "class" idea can be killed by every laborer becoming a capitalist. We are already on the way to this in the United States. The huge mass of capital is the aggregated savings of the workers. When all wage earners save systematically, they will be a vital part of the "Money Power." Increasing capital is the best way to increased production; increased production is the only way to permanent increase in wages; and wages set aside by thrift is the only way to increased capital. Here is a circle that is not vicious!

"This is all very fine," remarked an employer of labor recently, "but what arguments can we put up to our people on the various aspects of thrift?" This is a fair question, and here are some convincing answers, which may be used by the management in any business:

Why have a bank account?

1. A checking account enables you to pay your bills in a business way.
2. Your canceled checks are receipts for bills paid.
3. Doing business with a bank increases your credit and financial standing.
4. A bank pays interest on savings deposits.
5. Your money is safe in a bank.
6. A banker will give reliable advice on investments.
7. A bank is a safe place to leave valuables and important papers.
8. Doing business with a bank encourages you to save more.
9. A bank account tends to increase confidence in yourself.
10. Your deposits invested by the banker in industrial advancement directly contribute to the country's prosperity.

Why make a budget?

1. It helps to save more.
2. Helps to eliminate waste.
3. Makes it possible to give more.
4. Is using good business judgment.
5. Helps you to plan your spending.
6. Helps you to spend more wisely.
7. Helps you to know how much your taxes should be.
8. Helps you to know how much should be invested in life insurance.
9. Helps you to apportion large items of expense so that they can be more easily met.
10. Relieves you of constant worry as to how you stand financially.

Why carry life insurance?

1. It is a safe and sane investment.
2. Protects loved ones in case of emergency
3. Creates credit by which unexpected bills can be paid.
4. Increases happiness in home life.
5. Guarantees an income for old age.
6. Never decreases in value.
7. Indicates a good physical condition.
8. Helps you to save.
9. Enables you to educate the children.
10. Puts money at work for national prosperity.

Why own your own home?

1. It helps you to save.
2. Is a good investment.
3. Gives you a better standing in the community.
4. Increases your interest in your community and nation.
5. Enhances your self-respect.
6. Improves your credit.
7. Makes your family happier.
8. Improves your home life.
9. Gives you greater interest in your home.
10. Relieves you from the yoke of the rent profiteer.

Why share with others?

1. Because the practice provides sufficient financial resources to the church and all other worthy organizations, so that an aggressive and effective program can be accomplished.
2. Assures a clear conscience in regard to giving.
3. Is a businesslike method of helping support worthy institutions.
4. Helps the church to operate its finances in an effective way.
5. Makes for good citizenship and happiness on the part of those helped as well as those helping.
6. Enables a person to give a larger amount of money in the long run to unselfish causes.
7. Encourages one to be systematic about money matters.
8. Helps to a better use of all of one's resources.
9. Stimulates the use of a budget.
10. Develops character.

Why pay bills promptly?

1. A most important asset—credit—is established.
2. Eliminates the curse of debt.
3. Unpaid bills block the world's progress.
4. Eliminates the embarrassment of collection calls.
5. Increases self-respect.
6. Helps you save.
7. Improves your standing in your community.
8. Relieves you of financial worries.
9. It is the only square way to treat those who trust you.
10. It is a businesslike method of procedure.

Why make a will?

1. It is a moral obligation to be discharged.
2. Directs that your property be divided as you desire.
3. Avoids the possibility of no end of complications that may arise over a will-less estate.
4. Helps you to place at your family's disposal funds for immediate financial needs.
5. Insures a minimum of legal expense to your heirs.
6. Requires you to check up on your resources.
7. Stimulates you to make possible adequate provision for your family.
8. Increases the confidence of your family in you.
9. Increases your own self-respect.
10. It is a display of good business sense.

Utah Copper's Mining and Milling Costs

The per-ton operating costs of Utah Copper Co. on concentrating ore, including all fixed, general and maintenance charges, for the years 1910 to 1923 inclusive, are given in the last annual report of the company, as follows:

Year	Tonnages	Mining	Ore Delivery	Milling	Total
1910	4,340,245	$0.4097	$0.2978	$0.4663	$1.1738
1911	4,680,801	.4479	.3078	.4168	1.1725
1912	5,315,321	.4233	.2848	.4158	1.1239
1913	7,519,392	.3288	.2797	.3676	.9761
1914	6,470,166	.3232	.2782	.3536	.9550
1915	8,494,300	.2441	.2781	.3402	.8624
1916	10,994,000	.2781	.2792	.3782	.9355
1917	12,542,000	.4446	.2794	.6930	1.4170
1918	12,160,700	.5370	.2983	.9277	1.7630
1919	5,538,700	.4900	.3040	1.2062	2.0002
1920	5,556,800	.4823	.2591	1.2472	1.9886
1921	1,220,700	.4998	.1921	1.1679	1.8598
1922	4,364,251	.3833	.1612	.8417	1.3862
1923	11,167,800	.3488	.1088	.6116	1.0692

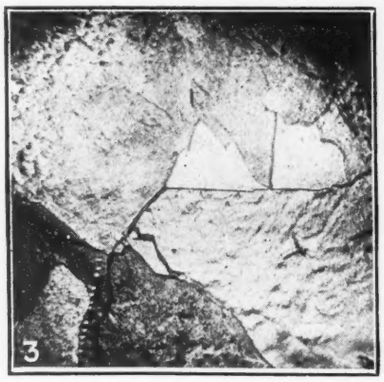
Structure of Native Copper

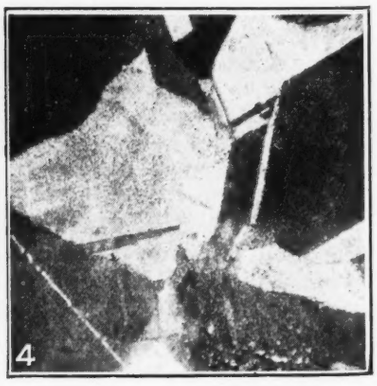
By Charles Y. Clayton
Professor of Metallurgy and Ore Dressing, Rolla, Mo.

Dana, in his "Textbook of Mineralogy," states that native copper is commonly twinned, and all specimens of native copper that I have examined have exhibited twinned crystals on a polished and etched microsection.

Photomicrographs of native copper, Figs. 1, 2, 3, and 4, illustrate this twinning, which is characteristic of both native and annealed copper (annealed after rolling). The question that arises is this: Are these twins congenital, or are they due to pressure and heat after deposition?

The copper of Fig. 1 was found near Sullivan, Mo. The copper of Figs. 2, 3, and 4 originated in the Michigan district. Photomicrographs Figs. 3 and 4 were furnished through the courtesy of the Calumet & Hecla Mining Co.





Photomicrographs of native copper, about 1¾ natural size. Etched with dilute nitric acid.

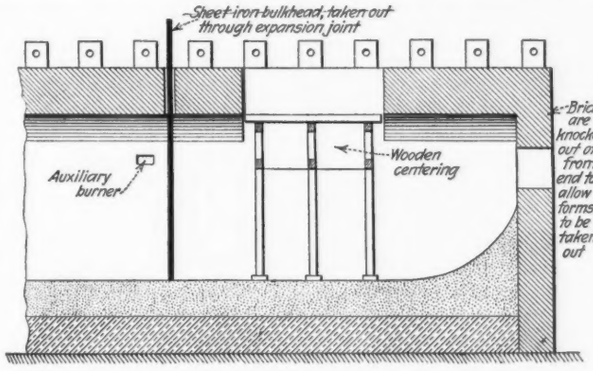
Useful Operating Ideas

Reverberatory Furnace Repairs

By Frank R. Corwin

A RELATIVELY SIMPLE METHOD of making arch repairs upon a reverberatory smelting furnace has been developed by the Southwest Metals Co. at its smelter in Humboldt, Ariz. The reverberatory is 19.5x100 ft. in hearth dimensions. It was put in operation on July 1, 1922, after a shutdown of somewhat over eighteen months. The furnace had been operating more than seventeen months at about 50 per cent of its capacity, when the smelter recently shut down.

In making repairs to the arch, the furnace is shut down, if possible, before the arch falls in. The first step is to skim the furnace and clean the slag and such portions of the charge as may be in the furnace at the time. After skimming as clean as possible, two auxiliary oil burners are put through the side walls of the furnace just ahead of the arch section to be replaced, and the section is bulkheaded off with sheet iron at an expansion joint just back of the auxiliary burners. Water from a fire hose is thrown into the furnace from the burner end, care being taken to avoid an accumulation of water sufficient to cause an explosion. The surface of the molten mass is thus chilled. The bricks in the section to be repaired are then knocked into the furnace by using long bars and working from the feed floor. After knocking in all of the brick the workmen are sent in and the bricks thrown out, water being sprayed into the hot section from time to time so that the men can work. After clearing the bricks out, wooden forms are placed in position as shown in the accompanying sketch and the brick masons begin building up the arch.


Sheet iron bulkhead, taken out through expansion joint
Bricks are knocked out of front end to allow forms to be taken out
Wooden centering
Auxiliary burner

Longitudinal section of reverberating furnace

When the bricks are in place and the arch is keyed, the tierods are tightened and the forms and bulkhead are taken out. A light wood fire is started just ahead of the auxiliary burners. After heating the arch for a short time, the center and the two side burners are turned on, using a very small amount of oil. The burners are thus operated for four hours, and then the two remaining burners are turned on, and the oil is gradually increased until the furnace is up to the smelting temperature. The arch is allowed to rise about 1.5 in. and it is then stulled down, and the tierods are loosened so as to keep it in this condition. The auxiliary burners are then removed and normal operations resumed.

During the operating period of seventeen months four arch-repair jobs and one uptake repair job were made with an average elapsed time of 21.2 hours for each job, including the uptake, and the average cost, including labor, lumber for forms, brick, steel and other material, was $2,638. The average number of brick used was 6,922 for each job. The total tonnage smelted during the period was 160,200, using 4,675,000 gal. of 14 deg. Bé. fuel oil. The cost of repairs per ton solid charge smelted during the period averaged 8.23c. The details of cost are given in the accompanying table.

Reverberatory Furnace Repair-cost Data

Date of Job	Number of Brick Used	Cost of Brick Used	Cost of Labor on Job	Miscellaneous Costs	Total Costs	Tons Smelted	Cost per Ton, Cents
Nov. 5, 1922.....	3,032	$1,141.29	$231.17	$8.70	$1,381.16	29,560	4.67
March 3, 1923.....	4,512	1,635.76	366.96	41.57	2,044.29	46,000	4.44
April 23, 1923.....	12,406	2,304.94	392.06	38.27	2,735.27	9,119	30.00
July 7, 1923.....	4,450	1,707.90	247.92	108.37	2,064.19	37,856	5.45
Dec. 3, 1923.....	10,244	4,058.80	723.56	182.77	4,965.13	37,665	13.18
Totals.....	34,644	$10,848.69	$1,961.67	$379.68	$13,190.04	160,200	8.23

Use of Quarry Bars in Slate Mining

To avoid excessive wastage in quarrying slate the channeling machine has been supplanted advantageously in some instances by the quarry bar. According to Oliver Bowles in Bureau of Mines Serial No. 2532, the quarry bar is mounted upon heavy wooden frames to give rigidity. The holes are drilled by a hammer drill of the mounted type and the cores between the holes are made 0.75 in. at the top. A 2.25-in. starting bit, ½-in. bit changes, and steel changes of 2 ft. are used. The rate of drilling is 1 ft. per minute of actual drilling time. The cuttings are blown out by air, hollow steel being used.

Nine hours is required to drill a row of holes 8.5 ft. long from one position of the bar, each hole being 8 ft. in depth. The cores are removed by a broaching tool operated by a reciprocating drill. The drill is moved back and forth on the bar so as to reduce the cores simultaneously. A sprocket wheel operated by a chain is used to move the drill. Steel is changed each foot, the width of cut at the bottom being 1⅛ in. and at the top 2 in. The face of the broaching bit is from 2 to 4 in. long.

The upper part of the channel is cut dry, but below 2 ft. water is used. Broaching requires a day. A cut 8x8.5 ft. requires two days to complete. Channeling

machines gave a rate of 64 sq.ft. per day, or about twice the rate of drilling and broaching. The equipment investment for channeling machines is greater, as are also operating and maintenance costs. Shattering results in wastage and has been greatly reduced by the use of the quarry bar and broaching bit.

Cleaning Vacuum Filter Leaves

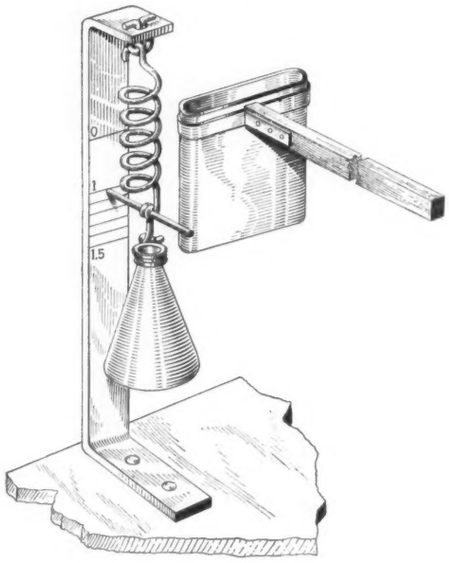
Alexander Fraser states in the *Journal* of the Chemical, Metallurgical and Mining Society of South Africa that in filtering Great Boulder roasted ore pulp, the solution which is saturated with gypsum causes the filter leaves to become impervious after twelve days' use. The scale deposited contains 61.5 per cent calcium sulphate and 14.6 per cent calcium carbonate, the residue being caked ore particles. The usual method of circulating weak hydrochloric acid through the cloths is unsatisfactory, as the weak acid does not attack the crystalline scale and if stronger acid is used the filter cloths are destroyed.

The method in use consists of submerging the filter leaves in a weak sulphuric-acid bath, 1 to 2 per cent, soaking them for several hours, thus changing the carbonate scale to sulphate, and then rinsing in water or a weak alkali solution and pumping water through the leaves for twenty-four to seventy-two hours, according to the thickness of the sulphate scale. The filter leaves are cleaned weekly by this system and an excellent filtering surface is maintained by the use of one-third of a pound of sulphuric acid per square yard of filtering surface.

Experiments were conducted to determine the solubilities of calcium sulphate in hyposulphite of soda and salt water. An increased solubility was noted, but it was not necessary to use such solutions.

Determination of Pulp Densities

A convenient and simple type of jolly balance can be rigged up for the quick determination of pulp densities. The arrangement is shown in the accompanying illustration. It consists of a metal or wooden strip to the upper part of which is attached a brass spring of sufficient stiffness for the purpose. An Erlenmeyer flask of 250 or 500 c.c. capacity is used to contain the pulp.



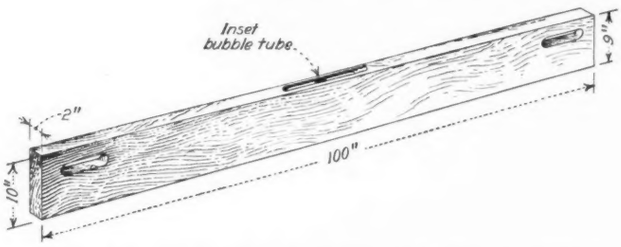
Jolly balance for determining pulp densities

The instrument is calibrated by marking the zero point when the empty flask is suspended and marking unity when it is completely filled with water. The flask is emptied and filled with a pulp of known specific gravity and the point marked. Intermediate divisions are spaced equally.

In taking samples the flask can be filled by means of a funnel or by a tobacco can attached to a wooden handle. The latter is used to dip the sample up from the launder. The level of the fluid in the flask must be flush with the top and the exterior of the flask wiped dry. A metal flask can be made. The same flask must be used on the determinations; otherwise the scale graduations will be in error.

Establishing Grades in Drifts and Adits

Under ordinary conditions the mine surveyor establishes the grade in drifts, crosscuts, and adits at intervals of 50 or 100 ft. by means of the transit. For much of the development work grades can be more conveniently set by means of the grade stick. In Bulletin 215, U. S. Bureau of Mines, the grade stick shown in the accompanying figure is described as follows: The grade stick is 100 in. in length and will cover three track ties spaced 2.5 ft. apart. It is 10 in. high at one end and 9 in. at the other. This establishes a grade of one per cent. In using the stick the 10-in. end is placed on the tie at grade and the 9-in. end on the tie to be brought to grade. This tie is raised or lowered until the bubble tube is at its center position and the tie is then blocked into position.



Grade stick for using in drifts and other workings

Advantages of Ordering Safety Fuse Coiled on Reels

Safety fuse, according to the *Detonator*, can be obtained coiled on pressed steel reels, 13.5 in. in diameter by 14 in. wide, containing 3,000 ft. As much as 4 per cent more fuse is made available by the avoidance of unusable short pieces that result where the 50-ft. coils are used. In addition, the larger coils are packed in cardboard cartons, which are lighter than an equivalent footage packed in wooden boxes, thus saving freight. By mounting four reels upon a piece of pipe and arranging three or more tiers, twelve or more fuse lengths can be cut simultaneously with one of the large fuse cutters of the bench type.

Emergency Sheet Packing

Charles Labbe states that where regular sheet packing is not available an excellent temporary substitute is heavy roofing paper.

Discussion

"Engineering and Mining Journal-Press" is not responsible for statements or opinions published under "Discussion." In many cases the views expressed are diametrically opposed to editorial policy and belief.

The Stock-raiser and the Miner

THE EDITOR:

Sir—We are interested in the articles appearing in the *Mining Journal-Press* concerning stock-raising homesteads filed over mineral lands. I hope that you will bring more light on this matter; it must be of vital importance to many of your readers. We will state our own case as an example of how this law acts when it gets loose in a mining district.

We have three patented mining claims, and operate a producing mine in the Swisshelm district, Cochise County, Ariz. In 1916 the section land we are in was thrown open for stock-grazing homestead purposes. The section is unsurveyed. So far as we know the Land Office at that time knew nothing about this section being the major part, so far as mineralization goes, of one of the oldest mining districts in Arizona. With a swipe of the official pen a section of unsurveyed land containing four mines, a half dozen families of permament residents actively engaged in mining and shipping ore, with 75 per cent of the surface covered by valid mining claims, of which sixty acres was patented ground, was thrown open to a squatter for "stock-raising" purposes and fenced by him to run two mangy cows in!

Backed by the supposed law, the squatter has barb-wired the section of land, and claims the right to fence off the old mountain trails in and out of the district, even attempting to deny our employees the right to use them coming from their ranch homes to work. He has brought cases in the local courts claiming pasturage on horses used by our employees, and turned loose on our ground. He has torn up a cattle-guard in the only road in or out of this part of the district and substituted a gate, to annoy us in trucking ore; setting up the claim that it rests with him to say what kind of a gate he will permit us to use, and bringing action in the courts when his spite gate is broken. The setting aside of a section of land like this in an old, productive, and still going mining district for stock-raising purposes is an outrageous violation of the rights of miners, and a breach of good faith on the part of the United States Government.

According to the best information we have been able to gather, a "valid" mining claim must have "mineral in place." If a mining claim has not "mineral in place" it is not "valid." On this ground a homesteader can contest and take possession of any claim located to cover and protect the initial location at the ore outcrop. And he seems to be doing it! The fellow who has enough capital to buy a few spools of barbed wire and who can stick around long enough to patent and sell out to the stockman, is wiping out the mining claims of the prospector or putting him to expense and annoyance to defend claims located before the grazing homestead law was ever heard of. The ultimate purpose of the squatter is also to have a basis for a contest, so that some day he can claim possession of all those unpatented claims that cannot be proven to have ore on the surface, to have something by which unscrupulous lawyers can shake down the holders of outlying claims located to protect their mineral deposits.

Of course, the prospector has the right to prospect for ore even on a stock-grazing homestead, as it is "reserved" by Uncle Sam. He has a perfect legal right to go inside a homesteader's 640 acre fence—if he breaks a gate or a barbed-wire fence down—and stands his ground with a Winchester. He can turn a rock over—if he puts up a $1,000 bond. He can get water somewhere else; for every spring and seep belongs to the homesteader—no matter what the law says, either. And he can recover possession of his burro, run out or grabbed for pasturage, if he lays off a day and hoofs it twenty miles to see the local justice.

Oh, yes, he can prospect on stock-grazing homesteads. But he won't! And he isn't; for he is gone. He is weary of life, and tired of a game where the cards are stacked against him. He is gone, never to return. And so are the chances of having new mines developed wherever the stock-grazing homestead law has descended upon the hills like the pestilence that it is.

Elfrida, Ariz. ROBERT RANDELL.

Silver-bearing Petrified Wood

THE EDITOR:

Sir—In your issue of April 19, 1924, is an article by Victor G. Hills on "Petrified Wood Carrying Silver at Creede, Colo." This deposit has been recognized by engineers who have operated in that district for many years. It is truly an unusual deposit, but Mr. Hills fails to call attention to certain facts which probably have some bearing on its origin.

The Bachelor Mine, mentioned by Mr. Hills, is the southern end of the famous Bachelor-Amethyst vein, which was probably one of the strongest and most extensive silver veins in this country. This vein was mined for two miles or more almost without a break, and from the surface to from 1,000 to 1,400 ft. on the dip. It produced many millions, and in places the stopes of shipping ore were 50 ft. and more in width. This vein is a fault fissure vein, lying between two rhyolites, and has been explored to a depth of 1,800 ft. or more on the dip and for three miles along its strike. The largest orebodies were found from a few hundred feet below surface to 800 or 900 ft. in depth. In this section there was without doubt considerable secondary deposition.

The general country is a mass of eruptive rocks and dikes. It is very rough and precipitous. The particular flow carrying the petrified wood is one of many and can

be identified to within a hundred yards or so of the main Bachelor vein. It is more than possible that it at one time either covered the Bachelor-Amethyst vein, or at least covered the rhyolite mass which forms the hanging wall of the vein. This is a highly mineralized district, with innumerable veins, some of which have furnished some high-grade silver ore. It is, therefore, evident that the source of the solutions which mineralized this strata might easily have been the Bachelor-Amethyst vein or one of the other veins in the district. It is also possible that this particular strata or flow was not originally as highly silicified as it now is—that it was at one time more porous, and either primary or secondary solutions might have found it favorable as an outlet from the main deposits. It does not require a very powerful imagination to suppose that these solutions, percolating through this formation, encountered organic material which had been imbedded in it, and the silver minerals were deposited as a result.

Hailey, Idaho. A. E. RING.

The Last of the Mohicans—A Lament

THE EDITOR:

Sir—Yesterday the University of California graduated two thousand one hundred and fifty-five students. One mining engineer and some forty lawyers took their degrees. Forty parasites and future blockheaded Congressmen to one doer and producer. To such a pass has the noble profession of mining arrived in California, the state whose production of gold set the clock of civilization ahead a full century and lifted industry out of sodden drudgery into a brighter and happier existence the world over.

The student realizes the fact that a profession which has so degraded that its technical men are forced to cadge for alleged exploration companies or take jobs as muckers is one not to be followed any more. Will you permit me to give the reasons for this collapse? Here they are: The smelter trust and its insoluble residue—Pinchotism, Reserves, "Conservation," Coffee Coolerism, Robber Railroad Rates on ore and concentrates from mine to market, a tonnage which cannot be frozen, burned, starved or destroyed in wrecks en route; Bureaucracy and its attendant idiotic cigar smoke tests, perversion of mining engineering into mining auditorism which knows nothing but to figure ore blocked out on three sides—or six.

"Imagination rules the world" except the world of the modern mining auditors. They are not engineers. Engineers plan, dream and construct real actualities. Blue-skyism which limits the activity of no crook but paralyzes the efforts of the prospector. Oceans of esoteric bunk relative to bonds, "protect the widow and orphan," promulgated in all the sheets which coincidentally print page ads. of gland rot and lip-stick toilet powder slop.

"Pure advertising" and national state, county and city boards of trade, rotating clubs, etc., all damning mining. The poor fools. Mining bureaus transformed into mining mausoleums and run by kindergarten practitioners who are great for inserting their noses into every mine operator's business. Why, if the tradesmen of the country were hampered and bedevilled from stem to stern as the mine owner and prospector are, even the tailor and peanut vendor would organize a revolution.

"Legitimate business!"

One mining engineer out of 2,155 graduates! At least let us hope that he will not degenerate into a mere mining auditor.

Counterpart of the New Zealander soliloquizing on the ruins of London from the lone remaining vestige of London Bridge: I salute you, the last lone hope of the University of California for 1924!

San Francisco. N. E. GUYOT,
Prospector.

A Doctor Prescribes for the Prospector

THE EDITOR:

Sir—I have read with great interest the article in your issue of April 26, 1924, by Arthur B. Parsons, on "Financing the Prospect." Two statements in the article are particularly true. "For the big companies are interested only in the almost proven mine" and "What possible chances has a man whose decency compels him to tell the truth about a property . . . in competition with the unscrupulous salesman?"

Preventive medicine is the order of the day. Why not apply it to the mining industry? It is far less costly and more effective than cure.

My clinical charts show that, like a new-born infant, a mineral prospect or project is no sooner discovered or formed, than it becomes the prey of all the germs and parasites that mines are subject to. As a result we have a number of diseases (especially those peculiar to childhood), many of which are fatal. It is between the prospector's discovery and the subsequent investigation and development of the prospect that mine diseases start, and many a good prospect or mine has gone begging, many a good prospector has been discouraged and driven into the hands of the Philistines, and a large number of good people have lost money and confidence as a result.

Under existing conditions what possible chance has a discoverer, prospector, or promoter, who has a prospect or property and is willing to tell the truth about his property, to get money to develop it? One in a million, and one hundred out of every hundred prospects require capital to determine what they are worth.

On the other hand, properly organized corporations, by a little investigation and expenditure of money, would have settled the question one way or another. Time, labor, and capital would have been saved. Either a valuable mine would have resulted, or every one would have returned to work with satisfied wholeheartedness, and confidence would not have been lost.

No matter from what angle we may view the situation, business ventures of all kinds are subject to risks; they are greater in the mining business than in most others, but so are the gains. What investor, prospector, corporation, or promoter would not be satisfied if he knew his money had been spent in an honest endeavor to prove a property? Even if you will call it a gamble, let us gamble fairly.

The following would result:

Abolition of the heterogeneous mass of parasitic stock companies, promotors, syndicates, etc.

Rapid opening up and development of new territory.

Increase in Canada's mining industry.

Reduction in amount of unemployment.

Increase of railway building.

Making possible the use of low-grade ores.

Installation of co-operation, decency, and fair dealing into mining business.

Doing away with the necessity of government bounty on ores.

Making Canada a poor place to separate fools and a few wise men from their money.

Sault Ste. Marie, Ont. H. D. MORRIS, M. D.

Sampling and Estimation of Ore

THE EDITOR:

Sir—In an extensive discussion on the general subject of sampling, appearing in the technical press from about 1915 to 1922, considerable space in the *Mining & Scientific Press* was devoted to what was called the "Webber Method" or "Combination Method"; in which a "mill-test" or "bulk-sample" was advocated for determining the factor of sampling-error. Great credit is due Morton Webber for his valuable contributions to the subject. It is to be hoped that pecuniary success has rewarded his efforts to improve sampling methods in general.

Mr. Webber states[1] that the bulk-sample automatically eliminates and discloses the sampling-error; adding that the information is confined largely to the place from which ore is removed.

Assume a hypothetical case of a block of ore 100 ft. on strike of vein and 100 ft. either vertically or on plane of vein along the dip, sampled on two horizontal levels by groove-samples (or call them channel-samples, cut-samples, moil-samples, or by any other pet name except hand-samples or face-samples) cut either by moil and hand-hammer work or by some convenient air-driven chipping machine at 5-ft. intervals along the strike. The purpose is assumed to be that of estimating, within reasonable limits, the grade and tonnage of ore that can be mined profitably from within the limits of the 100-ft. block.

Assume that a few bulk-samples would give us some factor, supposedly indicative of the sampling-error, by the use of which a plus or minus correction might be applied to the results of the actual sampling along a part of the perimeter of the block. Mr. Webber tells us, in the article cited, that he cuts a row of channels from wall to wall; then takes a slice of ore off the backs about one foot deep, then a new set of channel samples; then another one-foot slice of ore; and so on. Logically, the factor obtained by comparison of assay of reduced bulk-sample with the average assay or composite assay of the channel-samples covers the reliability of channel-sampling on a face of ore *as respects the continuity of ore to a depth of one foot from the face sampled.* Nothing more than that.

What is desired is to know the reliability of a sample, taken on a part of the perimeter of a block of ore, *as respects the continuity of ore to a point fifty feet from the face.* That being the case, why are those follow-up channel-samples taken? Because of a fear that the discrepancy will be too large? Why destroy the efficiency of the bulk-sample test by edging up and fudging the result?

Would it not be more rational to pick at random one or more 10-ft. stretches of the 100 ft. of level; take channel-samples at 0.5-ft. interval on backs; and then definitely stop sampling and just stope the 10-ft. section to a vertical height of about 10 ft.; thus reproducing the specified conditions on a scale of 1 to 10?

If there is going to be any plus or minus factor of sampling-error, it is not logical to seek it by sneaking up on the stope work to get extra samples. Such a method is reminiscent of the school boy who peeps at the papers of his classmates during an examination. The final paper of such a boy not only fails to give information as to just what the boy knew about the subject at the time of the examination, but, if his classmates knew a trifle less than he did, yet he in his nervousness assuming the contrary, the professor might get an entirely erroneous estimate of the boy's knowledge. WILLIAM B. MCKINLAY.

Yonkers, N. Y.

[1] *M. & S. Press*, Vol. 120, Feb. 28, 1920, p. 303.

Away with the Gold Standard?

THE EDITOR:

Sir—I am not sure whether it is permitted to review a reviewer. However, in discussing my book, "The Economics of Freedom," F. E. Wormser turns my vital fraction upside down, and then says it appears too abstract for any practical use.

What I put forward is an application of Ohm's law to economic effort, stating that value is directly proportional to effort and inversely proportional to resistance, or

$$\text{Value} = \frac{\text{Effort}}{\text{Resistance}}$$

Mr. Wormser accuses me of saying the reverse—namely,

$$\text{Value} = \frac{\text{Resistance}}{\text{Effort}}$$

I do not wonder that this looks abstract to Mr. Wormser.

As for the complexity of my proposed unit of value designed to measure effective work, I would point out that such a unit must be three-dimensional. It is the simplicity of the gold standard that has made a farce of savings, investments, and life insurance. From a scientific standpoint, a ten-millionth part of a rational assumption of unity, however complex unity may be, is far more important than ten million so-called *"stable"* units that bear no relation to unity.

In regard to the equalization of interior values, no claim is made by me that a scientific unit of value is going to establish a fixed ratio between silver and copper, as Mr. Wormser implies, any more than the physicist's use of a complex and comprehensive unit such as the foot-pound-second establishes a fixed ratio between the effective effort of mules and Fords.

Finally, in answer to Mr. Wormser's question, How will this currency (based on land-area, population, and time) be used in the settlement of international obligations? I show at some length that gold will continue to be used exactly as it is today. It is no use pretending that we are working on the basis of any international gold parity, when the dollar, the pound, the franc, and the lira alter their relationship every couple of hours.

The superstitious belief in an international parity dies hard; but while I was in China a few months ago the Chinaman was getting a good deal of amusement out of France's refusal to accept payment of a Chinese debt in French francs. DAVID ATKINS.

San Francisco.

News of the Week

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Summary

LITTLE INTEREST is manifested in Washington over the proposed tariff of 6c. per lb. on foreign copper. Support is almost entirely from Michigan, Western producers to date apparently not having urged Congressmen from their states to support the measure.

The Anaconda Copper Mining Co. has shut down its Tramway mine, one of the largest producers at Butte.

Raising $50,000 to finance the campaign to advertise zinc has been undertaken in the Joplin-Miami zinc-lead district.

The Silver King Coalition Mines Co. has acquired 1,400 acres of mining land adjoining its property at Park City, Utah.

Operations will be discontinued at once by the United Eastern and Tom Reed companies in the Oatman gold district in Arizona.

Production of copper for 5¾c. per lb. by "leaching in place" is expected by the Ohio Copper Co. in Utah.

Purchase of two claims for $150,000, of which $50,000 is cash, has settled the threatened apex trouble between the Ajax and Hercules companies in Idaho.

Copper production from the Belgian Congo is increasing steadily, the Katanga company having produced 12,650,000 lb. in April.

The firing of 182 tons of dynamite in a single shot recently loosened 2,000,000 tons of rock in a quarry at Corona, Calif.

Completion of a 200-ton mill and cyanide plant by the Flowery Comstock Mines Co., in Nevada, is scheduled for June.

Appropriation of $5,000,000 for exploration in search of potash has been approved by the Senate Committee on Agriculture.

Cia. Minera de Penoles has acquired a controlling interest in the Mosquetero Mining Co., owning valuable property in the Ahumada district, in Chihuahua.

Ajax Buys Claims, Thereby Settling Hercules Dispute

Pays $125,000 — Excellent Orebody Opened—Shipments to Start to Bunker Hill Smelter—Apex Question Involved

All question regarding the ownership of the great orebody struck by the Ajax Mining Co., in the Couer d'Alene district in Idaho, a few months ago, has been settled. The ore lies beneath the Wicket and Wicket fraction claims, owned by the Hercules Mining Co., a fact that the Ajax management fully anticipated, but having explored the vein by a series of tunnels practically from the apex, it was not expected that any question would be raised regarding its ownership under the law defining extralateral rights. Nevertheless the question was raised by the Hercules company, and for weeks the stage seemed set for apex litigation involving ownership of the ore.

After a conference in the East between Harry Day, president of the Hercules, and the Ajax directors, another conference was arranged in Spokane, attended by directors of both companies. This resulted in an agreement under which the Ajax company purchased the Wicket and Wicket fraction claims from the Hercules for $125,000, of which $50,000 was paid down and the remainder will be paid in installments of $25,000 a year beginning Jan. 1, 1925. Following the announcement of the settlement it was further announced that the Ajax company had entered into a contract with the Bunker Hill smelter for its entire ore output and that shipments will begin at once.

Anaconda Shuts Down Tramway Mine, at Butte

THE Anaconda Copper Mining Co. has suspended production from its Tramway mine, one of the largest in point of output in the Butte district. This shutdown is reported to be only temporary, and is caused by the poor condition of the shaft. Repair work will be started immediately; a good portion of the shaft will have to be re-timbered. Anaconda has been curtailing production in the last few months, and this step may be part of the general program.

Concentrator at Ouray Started

The concentrating mill on the Barsow group at Ouray, Colo., went into operation May 19, and will continue during the summer and fall. Leasers have 500 tons of ore on the dump ready for treatment.

Excellent Progress in Crestline Section, Joplin-Miami Field

Two Railroad Connections Being Made —Eagle-Picher Unwaters—Underwriters Mill Does Better than Anticipated

Steady progress is being made in the development of the Crestline, Kansas, field, and it should become one of the important sections of the district before the end of the year. Heretofore it has been lacking in railroad facilities, but two railroads are now building spur lines into it so that transportation facilities may be provided.

The Eagle-Picher Lead Co. is pushing unwatering, having installed pumps at the Ellis and Crutchfield mines that are now throwing about 4,500 gal. per minute. It is sinking the shaft at the Ellis as rapidly as the water will permit, and by the time the water is out, the mine will be ready to produce.

The Kansas Explorations Co. is proceeding with shaft sinking on its lease just north of the Crutchfield, and the Commonwealth company is putting down a shaft on the Chestnut lease, adjacent. Production at the new mill of the Underwriters Land Co. is reported better than expected, and the American Zinc, Lead & Smelting Co. is doing drill development work on the Oakley lease.

Peñoles Company Buys Mosqueteros Mine, in Ahumada District

Neighbor of Rich Lead-Silver Producers—Will Ship to El Paso Smelter

Cia. Minera de Peñoles, a subsidiary of the American Metal Co., has negotiated the purchase of a controlling interest in the Mosqueteros Mining Co. which owns a zinc-lead property adjoining the rich mines of the Erupcion and Ahumada companies that are shipping high-grade ore to the El Paso smelter. The district is situated about 80 miles south of El Paso.

The Peñoles company paid 20 to 25c. per share for 751,000 of the 1,500,000 shares outstanding.

Basil Prescott, who was instrumental in closing the transaction, is the man upon whose report Dr. L. D. Ricketts and General John C. Greenway are said to have taken over Erupcion and Ahumada.

Under the contract, the Peñoles company must start to work at once and must install a compressor and spend not less than $2,500 a month for the next six months upon the property.

Under the concession by which the Erupcion company built its railroad from Ahumada to the mines, it must operate as a common carrier, it is stated, and this gives the Peñoles people direct transportation to the El Paso smelter from the Mosqueteros.

The Mosqueteros has shipped some ore in the past, and the shipments are expected to increase. Some of the ore shipped to El Paso is said to have run 42 per cent in lead and 8 oz. in silver. A total of 268 ft. of tunneling has already been done.

It is claimed that fewer than 100 people hold the minority stock and that much of it is owned in El Paso and Juarez.

The National Lead Co., among others, was negotiating for the mine when the Peñoles company took it over.

The Peñoles company has a capital of $66,000,000 and is second only to the A. S. & R. Co. in the importance of its operations in Mexico.

Spruce Monarch Ships Thirty Tons Daily to Utah Smelters

The Spruce Monarch Lead & Silver Mining Co. is shipping about thirty tons of lead-silver ore daily from its Spruce Mountain mine. The ore is hauled 25 miles by truck to Tobar, Nev., on the Western Pacific R.R., and then shipped to Utah smelters.

Reports indicate that the ore shipped in recent months averaged 15 per cent lead and about 15 oz. silver per ton. Present production is coming from the 300 and 400 levels. On the 400 level a shoot of ore has been opened up which is 360 ft. long and 3 to 12 ft. wide.

A hot-head type compressor has recently been installed which will furnish air for three additional drills and an active campaign of development has been planned. The shaft is to be deepened below the 520 level, which is 100 ft. below the tunnel level; then the vein will be prospected at different elevations.

Joplin-Miami District Would Raise $50,000 to Advertise Zinc

AN organized effort is being made in the Joplin-Miami district to raise $50,000 as its share in the proposed $100,000 fund for zinc advertising, as planned by the American Zinc Institute.

Indefinite and ineffectual attempts along similar lines have been made before, but it is believed this attempt will be successful. Many of the prominent business and mining men of the district have been induced to co-operate, and success seems probable.

A good share of the money will be spent, if the campaign is a success, in harmony with the effort of the sheet-zinc makers to increase the demand for galvanized sheets. If the galvanized sheet demand could be brought back to what it ought to be it would mean an increased demand on this district of more than 100,000 tons of zinc ore.

Merger of Secondary Metal Interests Makes Strong Company

The Federated Metals Corporation is the name of the new company formed to merge the business of the Great Western Smelting & Refining Co., the Duquesne Reduction Co., the Union Smelting Refining Co., the Trenton Smelting & Refining Co., and the Eagle Smelting & Refining Works, the latter three being controlled by B. Lissberger Co., of New York. The new company will have facilities for refining 300,000,000 lb. of non-ferrous metals per year and will represent 10 per cent of the entire secondary metal business of the country.

The purposes of the consolidation are two: (1) to obtain special advantages in purchasing raw material, and (2) to effect economies in transportation, plant operation, and selling expense.

The directors of the corporation will include Charles M. Schwab, chairman of the Bethelehem Steel Corporation; Benjamin Lissberger, Max Lissberger, and A. Perry Osborn, of New York; Maurice Falk and Leon Falk, of Pittsburgh, and David Blum and Ivan Reitler, of Chicago.

The company will start with 400,000 authorized and 245,761 issued shares of no par value stock and $4,000,000 fifteen-year 7 per cent convertible bonds.

Verde Jerome Will Sink to 1,000 Ft.

The Verde Jerome Mining Co., whose property is located just west of the Verde Central mine in the Jerome district, in Arizona, has ordered heavy machinery that will make possible sinking of the shaft and other development. Plans call for the deepening of the shaft to the 1,000 level and other exploration work. The company is said to be financed, and the work is expected to be started at once.

Ohio Copper Co. Expects To Produce for 5.75c. per Pound

New Smelter Contract Will Cut ¼c. from Cost—525,000,000 Lb. of Copper Available for Leaching

The Ohio Copper Co., of Bingham, Utah, has concluded a smelting contract, which officials believe will enable it further to reduce production costs by about half a cent per pound, so that the cost per pound will be about 5.75c. The company is producing at the rate of 800,000 lb. of copper monthly, with a force of eight-five men, including office and railroad workers. This working force is compared to a force of 225 men in mine and mill before the starting of leaching-in-place operations, when the largest month's production was 600,000 lb. The precipitates average 94 per cent copper. About 1,200 gal. of water is being pumped and released on the slopes of the mine.

It is not planned to increase production at present, but the tailing dumps from the old mill have been sampled with a view to their being leached. During the summer and winter preparations for carrying on this work to the best advantage will be undertaken. These dumps comprise approximately 4,000,000 tons of tailing, which contain about 40,000,000 lb. of copper. With this included, it is estimated that more than 525,000,000 lb. of copper is available for leaching purposes. Electric lights have been installed on the Mascotte tunnel level, and a sidewalk has been laid between launders, so that it is possible to go underground without making a change of clothes or wearing rubbers, and still keep one's feet and clothing dry.

Mabel Again Active, Following Fire Last March

The West End Consolidated Mining Co. reports resumption of work at its Mabel mine, 20 miles from Mina, Nev. Repairs to the compressor plant were completed prior to that date and actual mining and development has been resumed on the 300, 313, and 400 levels. The power plant was destroyed by fire on March 30 and difficulty in obtaining repair parts resulted in a loss of six weeks' operations.

Bonanza Ore Reported in Jib Mine in Montana

A 4-ft. vein of high-grade gold-copper ore has been opened by the Jib Consolidated Mining Co., operating the old Hope and Katie mines, at Basin, Mont. According to reports from the mine this ore was first cut on the 400 level at a point 200 ft. east of the main shaft and has been drifted upon for 70 ft.

One ton of selected ore has been shipped to the smelter at Helena, where it was sampled and returned approximately $1,000. Some of the ore from the new find is being sent to the concentrator, where it has served to sweeten the mill heads materially.

The 300-ton plant which was recently remodeled is said to be giving excellent service.

United Mercury Mines Co. Will Erect Retort in Idaho

Forty-Ton Plant in Yellow Pine District in Valley County—Company Has Antimony and Gold

The United Mercury Mines Co., which owns 95 claims in the cinnabar section of the Yellow Pine mining district, in Valley County, Idaho, has given a contract to W. R. Boyden, of Spokane, for the construction and operation of a mercury retort of forty-ton daily capacity.

Under the terms of the contract, a Smith continuous retort is to be erected and in operation by Aug. 15, 1924. All of the material and equipment has been delivered at the mine, and construction work will start by June 1. Boyden is to furnish all equipment and erect the plant at an agreed price of $40,000, and this amount is to be returned to him on a royalty basis of 50 per cent of the net returns, the title to the plant remaining with Boyden until the entire sum is retired.

For the last three years the United Mercury Mines Co. has been actively engaged in developing its cinnabar mine. An average of twelve men has been continuously employed, and the officials declare they have a large tonnage of available ore. The principal work has been confined to the Hermes claim where the ore has been opened by three tunnels, which expose it for 1,700 ft. and to a depth of 270 ft. A number of crosscuts have shown high-grade ore to a width of 30 ft.

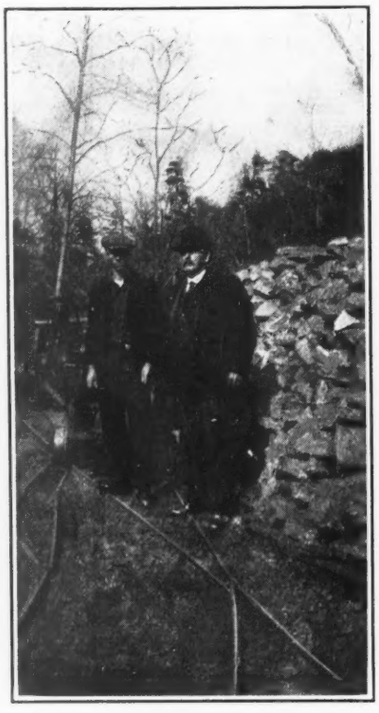
In addition to its cinnabar claims, the company owns a large antimony deposit and a gold-silver prospect in the same district. A small amount of work has been done on these deposits. The president reports that "the gold-silver vein has been opened for a width of 50 ft. by crosscuts from a 216-ft. drift on the vein at a vertical depth of approximately 400 ft., the ore showing a grade of $4 to $18 in gold and 3 to 30 oz. in silver," and that the antimony vein has been proven for a length of 360 ft. at a depth of 170 ft., at which depth it has an average width of 15 ft. carrying much high-grade stibnite ore. Development work on these deposits has not been pushed, as they cannot be exploited until the Forest Highway that is now under construction has been completed. This road is finished from Cascade to Yellow Pine, and when completed will open up one of the largest mineral districts in the state.

Tax Officials Told Copper Queen Is Going Down Hill

The Phelps Dodge Corporation has petitioned the state tax commission of Arizona for a change in classification of its Copper Queen properties for assessment purposes. The holdings are assessed as Class 1 mining property, that being mines located on veins which show no evidence of exhaustion, whereas Class 4, under which the representatives of the corporation claimed that the mines should be placed, are those that show evidence of exhaustion. The assessment of property for taxation purposes under the latter class is much lower.

Mine Paint in Georgia

The Lookout Paint Co. of Chattanooga, Tenn., is mining 100 tons per day from a 4-ft. vein of red iron ore in its mine at Cenchat, Ga. The operations are in charge of Eli P. St. Claire, who is general superintendent of mines for the Lookout company. The product is shipped to Chattanooga for manufacture into paint.



Near the portal of the Lookout mine at Cenchat, Ga.

New 200-Ton Mill and Cyanide Plant Nears Completion

Flowery Comstock Reports 130,000 Tons of $7 Gold Ore—Ground Surrendered by Comstock Merger

The Flowery Comstock Mines Co., whose property is near Six Mile Canyon, five miles east of Virginia City, and includes the Barry mine, the Rodgers, the Lady Bryan, and other old locations, is making rapid progress on the construction of its 200-ton mill and cyanide plant, and indications are that it will be completed by July. This ground was under option to the Comstock Merger interests, and they performed considerable development work before they formally relinquished their option last November.

The ore at present blocked out is above the tunnel level, and occurs as an irregular mass in so-called porphyry. It has been developed over an area approximately 120 ft. square, and to a depth of 160 ft. below the surface; an estimated tonnage of 130,000 tons which will average $7 per ton in gold. The ore is to be mined by raising and shrinkage, and finally by glory-holing when the stopes reach the surface. It will be transported to the mill by trolley locomotives. Steady operation is counted upon when the plant is in condition to start.

Much Development in Wood River District, in Idaho

Bunker Hill and Federal Companies Are Opening Old Properties — Hailey Bonanza Expects to Cut Shoot

Good "showings" are reported in a number of prospects and old mines being reopened in the Wood River district, of which Hailey, Idaho, is the center. The Hailey Bonanza has a crew driving the drift from the crosscut to get under the oreshoot above. John M. Price, the manager, hopes to reach the shoot early in June. He is using power drills and is making good progress with two shifts.

At the Westlake-Clarke-O'Neil property a nice showing of ore has been opened in two different places, and ore is being taken out for shipment. The property is situated on the head of Rock Creek, about six miles west and south of Hailey.

The Idaho Silver-Lead Co. has a showing of silver-lead ore in each of its properties. In the Snow Cloud group a 4-in. vein carries 110 oz. silver and 70 per cent lead, with a small amount of gold. The ore in the Prince Albert group is of lower grade, but assays show 55 oz. silver and 38 per cent lead.

The Bunker Hill & Sullivan company is working in the old Bullion district with a good force of men. It is driving to intercept the Red Elephant vein, that has produced a very large amount of ore in the past.

The Minnie Moore, which has produced over $10,000,000, is being unwatered by the Federal Mining & Smelting Co. preparatory to prospecting in an effort to pick up the ore again.

H. D. Jones, owner of the Rustler group on Rock Creek, about ten miles west of Hailey, has put some men to work opening the old shaft to get at some high-grade lead-silver ore that was left in the mine when the property shut down. The ore is said to carry 28 oz. silver and 55 per cent lead, with $6 gold.

Central Eureka Acquires New Property at Sutter Creek

A total of $150,000 is involved in the purchase by the Central Eureka Mining Co. of the Old Eureka property which lies north of the present holdings of the company at Sutter Creek, Calif. An initial payment of $10,000 has been made, the balance being payable in installments during the next three years.

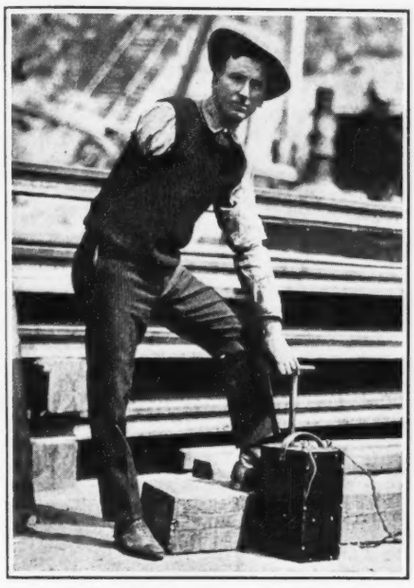
The Central Eureka Co. below its 3,500 level discovered a new orebody in a new vein in its own territory. Development workings on the orebody progressed beyond the Old Eureka end line, but were vertically beneath land owned by the Central Eureka. It was claimed that this new vein apexed on the surface in Central Eureka ground. The Old Eureka owners were aware of the work being done and protested against continuation of it. After extended negotiations the dispute over the ownership of the ore was compromised by the Central Eureka taking an option to purchase all of the mining ground formerly belonging to the Old Eureka.

Quarry Blast Loosens 2,000,000 Tons of Rock

Largest Shot of Its Kind Fired in United States—182 Tons of Dynamite Required—Cost Low

A spectacular blast, fired in the afternoon of April 27, at the quarry of the Blue Diamond Materials Co., Corona, Calif., loosened about 2,000,000 tons of rock for subsequent reduction in the plant alongside. The explosion was witnessed by about 15,000 spectators.

The driving of the tunnels and crosscuts near the face of the deposit occupied about two months, and 1,000 ft. of approaches was needed to connect with thirteen pockets or rooms, each 12x12 ft. These were loaded with 182 tons

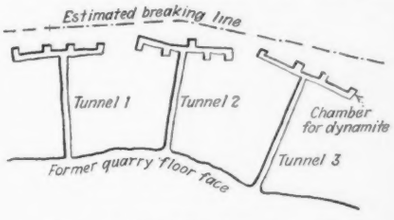


Earl Mack, quarry foreman

With one motion of his arm he released the force that broke 2,000,000 tons of rock.

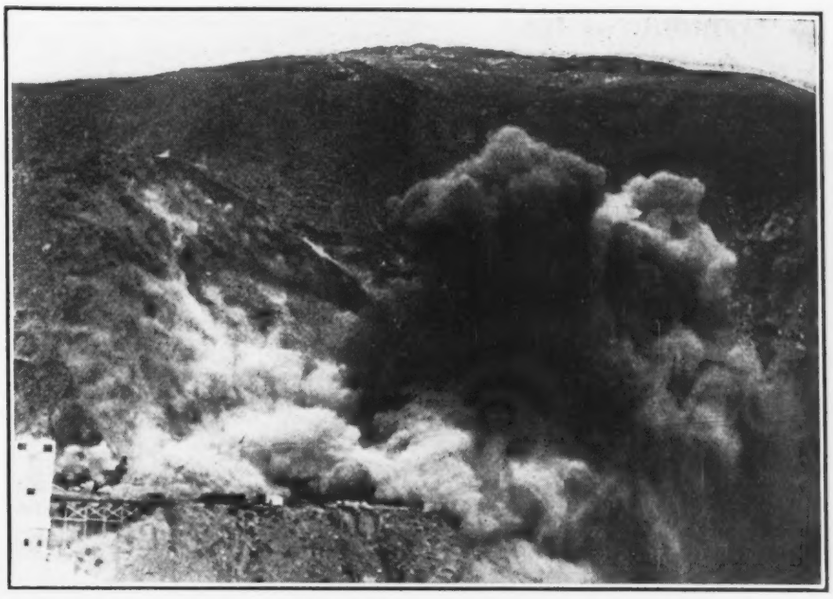
of dynamite, each room therefore containing fourteen tons. The task of passing the explosive from hand to hand required about six days. After the rooms were loaded, and the wiring was connected, the tunnels and crosscuts were filled with rock back to the quarry face. The firing switch was placed in the tower of the mill house.

Plans were made carefully according to a schedule. Precisely at 2:30 p.m.



Plan of the blasting chambers

the charges in all the rooms were fired simultaneously, the result being a thrilling spectacle for the observers stationed on the hill opposite to the quarry. Unfortunately, the company's official photographer was stationed too close, with the result that he was showered with rock. The accompanying halftones are from motion-picture



The hill as it looked a few seconds after the explosion

films, the explosion being registered by not fewer than twenty-eight motion-picture cameras.

An interesting feature was the attendance at the firing switch of five technical observers with special watches The group was sent by the Carnegie Institute of Washington to make scientific observations of the blast. A special seismograph was set up in the Mount Wilson observatory for the purpose of calculating the earth's wave motion created by the explosion. The delegation was in charge of Dr. Harry O. Wood, research associate of the Carnegie Institute, who reports that vibrations sent through the earth were clearly recorded by the instrument at Mount Wilson, a distance of about forty-two miles as the crow flies, and were also checked by radio time signals from Annapolis and Mare Island.

The technical engineer in charge of mining operations prior to the blast and responsible for the result was J. C. Cushing, of the Hercules Powder Co., who for seven years was identified with heavy blasting work in the Canal Zone. The electric switch was thrown in by Earl Mack, quarry foreman. Other officials include John Schreiner, production manager of the Blue Diamond Materials Co., and G. Haines, quarry superintendent for the company at Corona.

According to explosives engineers, the shot was the largest of its kind made in the United States. It yielded the anticipated volume of rock, throwing about 2,000,000 tons on the quarry floor. Most of this was in small sizes, and very little additional block shooting will be necessary. It is estimated that the total cost for shooting the rock to sizes that can be handled by the power shovels, and including what block shooting may be necessary, will be well under three cents per ton.

Preparing the wires for exploding the charge

Note the entrance to one of the three tunnels, now refilled with stone ready for the blast

London Letter

By W. A. Doman
Special Correspondent

Katanga Copper Output Grows Steadily; 12,610,000 Lb. in April

Immediate Goal Is 16,600,000 Lb.—Expect To See Lower Price When Output and Competition Increase

London, May 13—The copper production of the Katanga is growing apace. The Union Minière has apparently overcome all difficulties, and the goal at which Robert Williams aimed years ago—100,000 tons per annum—seems to be within measurable distance. In 1922 the output was 43,300 tons, in 1923 it was 57,823 tons, and this rate is now being largely exceeded. For the current year the production has been: January, 5,127 tons; February, 5,099; March, 6,121; and April, 6,305. April, therefore, beat the March record, and is at the rate of 75,600 tons per annum, or translated into pounds after the American fashion, 151,200,000.

Central Africa clearly contains some civilized spots, and is becoming a formidable competitor in copper. Rhodesian companies are anxious to increase their production, and though the idea prevails that uses will be found for all the metal turned out, there is in some quarters a little uneasiness as to what may happen two years or so hence, when, owing to competition, prices may be lower. It will then be necessary to prosecute large-scale working to cut down expenses.

Speculators who sold short of West Springs shares (Far Eastern Rand) found themselves in an awkward position and circulated rumors that the plant was not working satisfactorily. For some time no notice was taken of their attitude, but it is now officially announced that the plant is running well, and that between now and the end of June about 30,000 tons of ore, mainly from the dump, will have been treated. After June regular monthly outputs will be reported.

The fall in the price of tin from £290 to under £230 per ton has been, generally speaking, inexplicable. Statistically, the position is sound, and the demand for the metal, especially from Germany, is growing. The managing director of one of the leading metal-dealing companies has been interviewed on the subject, and his opinion is that the sharp advance of the last winter induced speculation, with the result that heavy bull commitments were entered into when prices were at the top.

From a speculative point of view the spring and summer months are not favorable. There is a seasonal falling off in the demand from the United States, and with weak and stale bull accounts open, only a little liquidation was required to cause a falling away of prices. The expert thinks the metal is not standing at its true value. What that value may be he does not say, but the inference from his statement is that the price of tin will recover.

Hugh F. Marriott has been officially appointed the representative of the Union of South Africa Government at the forthcoming Empire Mining Conference. This was rather unexpected, seeing that Mr. Marriott in his long tour of last year did not include South Africa, but confined himself to the Antipodes and the North American continent. His selection may be possibly due to his knowledge of mining and mining finance in South Africa, and to government requirements. In official and mining circles he is regarded as a "live wire"—too "live" for some people, for he does not mince his criticism when he thinks criticism needed.

Mexico City Letter

By W. L. Vail
Special Correspondent

Mexico Has 1,660 Active Mining Properties, Thinks Government

Gold, Silver and Lead Production Increased in 1923—A. S. & R. Will Not Abandon Aguascalientes at Once

Mexico City, May 20—According to reports by the mining department, there are now in force 6,024 mining titles in Mexico. Of this number 1,660 properties are actually working. According to returns filed in the public registry the amount of capital invested is 812,000,000 pesos, which is probably a low estimate, as returns are made for taxation purposes.

Actual production of some of the principal metals for the past two years is given as follows, the first figure in each case being 1922: Gold, 23,276 kg., valued at 31,034,589 pesos, and 24,172 kg., valued at 32,229,253 pesos; silver, 2,521,832 kg., valued at 112,448,176 pesos, and 2,824,599 kg., valued at 122,346,253 pesos; lead, 110,455,912 kg., valued at 27,404,695 pesos, and 155,720,342 kg., valued at 51,040,818 pesos; copper, 26,977,786 kg., valued at 15,746,265 pesos, and 53,371,582 kg., valued at 35,410,402 pesos; zinc, 6,141,937 kg., valued at 1,756,789 pesos, and 18,481,279 kg., valued at 4,901,841 pesos; mercury, 41,827 kg., valued at 125,985 pesos, and 44,751 kg., valued at 140,015 pesos; antimony, 463,815 kg., valued at 115,304 pesos, and 490,087 kg., valued at 197,208 pesos; graphite, 2,054,279 kg., valued at 239,571 pesos, and 5,489,198 kg., valued at 769,638 pesos. In 1923 approximately 20,000 tons of lead was consumed in local industries.

Reports of the removal of the American Smelting & Refining Co.'s, plant from Aguascalientes to San Luis Potosi appear to be premature, according to a statement made to the representative of the *Mining Journal-Press*. The new plant which is being erected at San Luis will not be ready for operation till 1925, by which time the company will decide upon the advisability of a complete abandonment of the work at Aguascalientes, or otherwise.

The well-known high-grade silver property, Tlachichilpa, for many years owned and operated by Iñigo Noriega, State of Morelos, has been sold to a French syndicate for a reported consideration of 500,000 pesos. The new company is making extensive improvements.

Melbourne Letter

By Peter G. Tait
Special Correspondent

New Guinea Gold Placers Not Promising, Says Barton

Some Good Assays, But Inaccessibility Is an Obstacle—Heavy Machinery Not Justified by Showing

Melbourne, April 17—B. V. Barton, who recently visited the mandated territory of New Guinea to examine and report on alluvial gold leases held under option by the Kaili Options N. L., has returned to Melbourne. In addressing a meeting of shareholders Mr. Barton stated that there were tremendous difficulties in exploring the region, as the greater part of New Guinea is virgin country. The main range, 7,000 ft. high, was passed over; also two other ranges of a height of about 6,000 ft., before arriving at the Bulolo Valley. The leases were fairly flat surrounded by hills rising to a height of 10,000 to 12,000 ft.

The fall of the river through the leases was 350 ft. The wash looked promising to start with, because good values were obtained in many places on the surface, but the conditions were different from Victoria, for there was no connection on the bottom.

A thorough sampling was carried out on the leases by sinking shafts, and in the six months Mr. Barton was there 750 ft. of sinking was undertaken. Leases 1, 2, 3 and 5 would not go more than 3d. per cubic yard, although there were a few patches that showed better values. There was a small yardage on Lease 6 that would yield up to nearly 3s. per cubic yard. The best values were on Lease 4, where the river junctioned with Namie Creek. From this point down the river there were approximately 1,000,000 cu.yd., worth 1s. 10d. per yard, but the wash was in patches. The lease by itself was no good to the company, for it could not be operated profitably. Values also existed on Lease 7, but heavy machinery would be required to work it, and there was no road into the country

A cable message received in Melbourne under date April 14 refers to a sample consignment of 168 lb. of mica (mixed grade) from Alice Springs, Central Australia, having been sold in New York at about 32s. per lb.

Mica has been discovered in several parts of Australia, but most of the production up to date is from the McDonnell Ranges in South Australia, about 800 miles distant from Port Augusta. One block raised there weighed about two tons and 600 lb. of mica were cut out of it. Difficulty of transport keeps back development, and the owners, who are working on quite a small scale, look forward to the time when the Odnadatta railway will be extended into Northern territory.

The Radium & Rare Earths Treatment Co. has been formed in Melbourne to develop the known occurrences of uranium ores in South Australia. Douglas Mawson, of the Adelaide University, is advising the company.

Silver King Coalition Acquires 1,400 Acres at Park City

Purchase of Consolidated Shares Announced—1,700-Ft. Tunnel Will Be Used for Exploration

The purchase, just consummated, of the Silver King Consolidated claims at Park City, Utah, by the Silver King Coalition Mines Co. marks another consolidation in the Park City district. The acquisition of this neighboring territory gives the Coalition 3,800 acres with a large area still undeveloped.

In the last thirty-two years the company has produced about $60,000,000. The Coalition lost an apex suit with its neighbor some years ago, as a consequence of which it paid about $1,000,000 for ore wrongfully mined.

The Silver King Consolidated owns 1,400 acres and has driven a 1,700-ft. tunnel which will afford an excellent point of departure for the development of the southwestern part of the Coalition properties. The purchase price of the Consolidated shares is $1 paid to James A. Hogle & Co., holder of the option. The finances of the Silver King Coalition are such that it will be possible to pay for the shares without outside help, and to leave about $500,000 in the treasury after payment has been completed.

The mine produces a large tonnage of direct-smelting ore, and the capacity of the mill is 800 tons daily. The company is making three mill products: a lead concentrate containing lead and silver; a zinc product practically all zinc; and an iron product containing iron, silver, and lead. A new and more favorable smelting contract is announced as having been negotiated.

Oatman, Ariz., Gold Mines Announce Exhaustion

The United Eastern Mining Co. and the Tom Reed Gold Mining Co., owning the two largest gold mines in Arizona, are to suspend operations this month. Both are in the Kingman-Oatman district. Representatives of the United Eastern company have appeared before the state tax commission and stated that the mine will cease operating on June 1, at which time all ore of the company will become exhausted.

The Tom Reed mill is making final cleanup of ore that has been mined by the company, but operations are to be continued under the leasing system. More than 100 miners have asked for leases, and the men are to be given blocks of ground for prospecting, the production from which will be shared with the company on a sliding-scale basis.

Cortez Operations Delayed by Fire in Power Plant

The power plant and inclosing building of the Consolidated Cortez Silver Mining Co., at Cortez, Nev., was damaged by fire of unknown origin on May 12. The loss was fully covered by insurance, and the plant will be repaired immediately. The milling plant was not damaged, but the loss of power resulted in temporary closing of the mill until repairs can be completed.

News from Washington

By PAUL WOOTON
Special Correspondent

Little Opposition to Six-cent Copper Tariff in Washington

Legislators Not Greatly Interested—Little Pressure for Duty Except From Michigan—Western Producers Seem Indifferent—Look for Improved Market When Germany Buys

INTRODUCTION by Representative James, of Michigan, of the bill proposing a 6c. duty on copper has had the effect of extending the discussion of this matter to Capitol Hill. Apparently, there is no particular opposition to the proposal. The demand for the legislation seems to come from Michigan alone. Representatives from the other copper-producing states, despite the fact that the subject has been under discussion for several months in the technical press, have had no expression from their constituencies.

Though Republicans hesitate to denounce a duty on anything, and Democrats are inclined to oppose any suggestion of a new duty, the real reaction on Capitol Hill is that a tariff on copper would do little good and, on the other hand, would do little harm. From the legislative standpoint, however, unusual difficulties would be faced, in that the placing of a duty on copper would involve extended alterations in the tariff law, because of the necessity of providing the compensatory duties on manufactures of copper.

A member of the House Ways and Means Committee, who was consulted about the matter, does not believe the proposal is regarded very seriously by the members of that committee. They are at a loss to understand how the high-cost mines of Michigan can be benefited when lower-cost producers are in a position to much more than satisfy all the domestic requirements. Before the war, there was an exportable surplus of 400,000,000 lb. of domestically produced copper after all domestic requirements had been supplied. In addition, 300,000,000 lb. was imported for treatment or manufacture here, thus giving a total of 700,000,000 lb. for export. Since the war, consumption has arisen to an annual average of 900,000,000 lb. Production continued at an average of 1,100,000,000 lb., approximately the pre-war rate, leaving a surplus of 200,000,000 lb. of copper produced from domestic sources. During the five years following the war, the amount of foreign copper brought in for refining or manufacture here has increased to 500,000,000 lb., bringing the total average annual exportable surplus to 700,000,000 lb. In a situation such as is reflected by these figures, it is difficult for members of the Ways and Means Committee to see where anyone would be benefited.

Copper specialists in the government service are inclined to think that the copper situation will improve. They realize that there are some operations in Michigan that have reached the point where costs have become prohibitive. Evidently the effort in France to substitute aluminum for copper has not progressed very far, as France continues to import copper at an increasing rate. Great Britain, Belgium, Italy, and certain other large purchasers of American copper are increasing their takings. It is believed that all that is needed to turn the market upward is for the German situation to be worked out to the point where its purchases will begin to approximate the normal demand of its industries.

Committee Recommends Passage of 14,000,000 Oz. Silver Purchase Bill

Pittman Gets Action in Face of Treasury Opposition—Oddie Charges "Embezzlement" by Officials

By unanimous vote, the Senate Committee on Banking and Currency on May 26 recommended the prompt passage of Senator Pittman's bill providing for the purchase at $1 an ounce of 14,589,731.13 oz. of silver. The committee's action was taken in the face of Treasury Department opposition.

It was Senator Pittman's original intention to secure a court interpretation of the Pittman act to determine whether or not the Treasury could replace the silver dollars it melted up for subsidiary coinage with silver obtained at the world price during the life of the Pittman act. It then occurred to him that more immediate action could be secured by legislation instructing the Secretary of the Treasury to purchase the 14,500,000 oz. at the Pittman price.

"It is remarkable," said Senator Pittman commenting on the action of the Banking and Currency Committee, "that a favorable report was unanimously voted considering the fact that the majority of the committee are Administration Republicans who naturally would have been inclined to support the Secretary of the Treasury."

Senator Pittman is still investigating the melting and shipment of about 29,000,000 silver dollars to China, which he contends also was in violation of the terms of the Pittman Act.

Senator Oddie Politely Declines to "Take Water" on Charge

In connection with the controversy with the Treasury over the amount of silver that should be purchased at Pittman prices, Senator Oddie, in a communication to a San Francisco newspaper, made the statement that the Treasury's action is equivalent to embezzlement. A Treasury official took

Will Re-smelt Old Slag at Leadville

A RAILWAY spur has been built and an automatic conveyor installed at the old Elgin smelter dump at Leadville, Colo., where preparations are being made for the extensive shipment of slag to the smelting plant of the American Smelting & Refining Co. The old slag pile is one of the oldest in the district, and extensive sampling indicates that it can be profitably retreated. It is expected that about 200 tons will be handled daily. Here is tangible evidence of the progress being made in the art of smelting.

brusque exception to the published statement and demanded an "immediate and public repudiation" on the part of Senator Oddie. In reply to that official, Senator Oddie said:

"If I can be convinced that the taking of money from the silver producers, money to which they were legally and morally entitled, and presenting it to the Treasury of the United States, as was done in this case, is not equivalent to embezzlement, I will be willing to admit that I am wrong."

No reply from the Treasury Department has been forthcoming.

Palms-Book Will Drill on Marquette Range, in Michigan

The Palms-Book Land Co., of Detroit, has secured a lease on 1,100 acres of land belonging to the Barnes Land Co., on the Marquette range, in Michigan, and will immediately start drilling for iron ore. The lands lie between the Barnes-Hecker mine of the Cleveland-Cliffs Iron Co. and the old Dexter mine, and very little exploratory work has been carried on in that field.

The Palms-Book Land Co. owns the fee of the Palms-Anvil and Mikado mines on the Gogebic range, and recently developed a fine body of iron ore in the Iron River district, on the Menominee range.

R. S. Archibald, of Negaunee, is in charge of the company's interests in the Lake Superior region and will look after the diamond drilling.

Michigan Iron Mines Close; Tonnage and Price Down

The Mary Charlotte and Francis iron mines, on the Marquette range, and the Zimmerman mine, Menominee range, in Michigan, have suspended operations. The Francis has been abandoned; the two others have been closed because of the low selling price of iron ore. It is not unlikely that other mines in Michigan will be forced to close, as the sales for 1924 are far below the average of recent years, though the price is 80c. a ton lower than the average of last year.

The movement down the Lakes is small at present and predictions are that not more than 45,000,000 tons will be shipped, as against 60,000,000 tons in 1923.

Committee Recommends Expenditure of $5,500,000 in Potash Search

Five-year Program of Exploration and Investigation—Would Make United States Independent of France and Germany

No voice was raised against the proposal to expend $5,500,000 in prospecting for potash in the Southwest when Senator Sheppard's bill came before the Senate. The bill was passed without the formality of a rollcall. The Committee on Agriculture of the Senate, in recommending the passage of the measure, reported in part as follows:

"Impressed with the need of developing a home supply of potash, the U. S. Geological Survey and the Bureau of Soils of the Department of Agriculture have employed for more than a decade every known method of research and discovery at their command. Experts of the Geological Survey stationed at various oil wells in southwestern United States, notably in western Texas, eastern New Mexico, western Oklahoma, and southwestern Kansas, have found specimens of potash in the natural state of such richness and of such varied location as to lead to the conclusion that there exists in these sections of the United States beds of natural potash rivaling those of Germany and France. They state that the proper method of exploration is by what is known as core drilling, the drilling of wells with implements which will bring to the surface the cores of the potash ores for analysis and study; that the minimum amount of drilling necessary to produce satisfactory results should cover at intervals an area of 200 to 300 square miles; that at least a hundred wells should be drilled to a depth of 2,500 to 3,500 ft., and that this could be done over a period of five years at an expense of $500,000 annually. In view of the fact that we are expending about fifteen and a half million dollars for potash from Germany and France, and in view of the need of an independent, domestic supply of an element so essential to national subsistence and defense, the Committee on Agriculture and Forestry believe that the country may well afford to expend this sum for the purpose indicated. The bill hereby recommended embodies the plan above proposed and we report it favorably. The bill provides that the government shall be at no expense for the land on which drillings are made and that if any minerals of value are found a lien shall be obtained for an amount sufficient to reimburse the government for its expenditures. The bill also provides certain safeguards against private monopoly and profiteering in the potash discovered. After the potash is found private enterprise is expected to take up the work of development under the terms laid down in the bill.

"The Bureau of Soils has also found that among the waste materials of the cement, blast furnace, beet sugar, distilling and wool-scouring industries, and the natural raw materials, such as the greensands of New Jersey, the leucites of Wyoming, the alunites of Utah, the natural brines of Nebraska, Utah, California, and perhaps other states, there are extensive sources of potash for which practical process of recovery and manufacture can be developed. It finds that with an expenditure of $50,000 annually for five years systematic chemical and engineering researches can be conducted in such a way as to bring about definite tests and results. For the reasons before indicated in connection with exploration work the committee believes that the Bureau of Soils should be authorized to pursue the course of action it has outlined.

"It is evident that the work of exploration and research herein authorized is of such difficult and expensive nature that adequate tests cannot be expected from private enterprise. In the interest of our national welfare, subsistence, and preservation the committee believes that this bill should pass."

Bay Horse Mines Will Have Mill in Oregon

THE Bay Horse Mines, near Huntington, Ore., will install electric power at once. Plans are completed for a 100-ton concentrator and mill to be erected this season. Development at depth of the property has opened sufficient ore to warrant the installation of the proposed plant.

The Bay Horse Mines, during the operation of the Pittman Act, shipped about 150,000 oz. of silver from surface workings and shallow openings the first eight months after it was rediscovered after lying undisturbed for thirty years. Several hundred thousand tons of milling ore carrying silver and copper are available for the mill at this time, according to Carl Anderson, manager.

Leadore Company Proposes To Resume in Idaho

Owners of the Leadore property, in Gilmore County, Idaho, are about to resume active mining and milling operations. This holding, which includes what were formerly known as the Kimmel and Leadville groups, has been taken over by the Leadore Mines Co. Resumption has been delayed on account of title difficulties which have now been cleared up.

The property has blocked out, according to reports, ore reserves of 700,000 tons, carrying 6 per cent lead and several ounces of silver per ton. A 50-ton pilot mill on the ground will be enlarged to 100 tons. The property is crossed by the Pittsburg & Gilmore railroad. The ore lies in a porphyry dike which can be traced on the surface for 4,000 ft. About 6,000 ft. of underground workings have explored and developed 628,000 tons of ore on the Leadville property and 42,800 tons on the Kimmel property. The ore-bearing dike is about 60 ft. wide. The possibilities for developing more ore are excellent, according to J. L. Magney, consulting engineer for the company.

Men You Should Know About

F. E. Calkins has returned from the examination of mines in Sonora.

C. E. Rodgers, mill superintendent of the Nighthawk Peninsular mine, has resigned.

C. E. Dobbin will engage in geological work this summer in Montana and Wyoming.

J. M. Carter, of the Nipissing Mining Co., has been promoted to the position of mill superintendent.

Albert Maverick, author of "Mine Bookkeeping," has removed from Copperhill, Tenn., to San Antonio, Tex.

Roger H. Downer has been appointed superintendent of the Florence Mine, at Goldfield, to succeed **R. C. McCarthy.**

Dr. R. B. Moore, who had been acting head of the development department of The Dorr Company, has been appointed general manager.

E. V. Neelands, manager of the Keeley mine, in South Lorrain, Ontario, has been appointed assistant manager of the Nipissing mine, in Cobalt.

E. O. Ulrich and **R. D. Mesler** are in Virginia and Tennessee to continue work begun last year on the Ordovician fossils of the Appalachian Valley.

Charles E. Rogers is at the Hotel Shelton in New York. He will return to London on the "Berengaria" on June 4, and later go to Johannesburg.

A. H. Hubbell, managing editor of *Mining Journal-Press,* has just returned from a three weeks' field trip through the metal and non-metallic mining districts of the southern states.

F. W. Bradley, of San Francisco, president of the Bunker Hill & Sullivan Mining & Concentrating Co., is at Kellogg, Idaho, where the company has extensive mining and smelting interests.

J. D. Sears, of the U. S. Geological Survey, arrived in Denver on May 13 to initiate a general plan of investigation and survey of the oil possibilities of northeastern Colorado, which has been authorized by the Survey.

Dr. Andrew C. Lawson, of the University of California, has been elected to membership of the National Academy of Sciences. Dr. Lawson has specialized in economic geology, earthquakes, and the geology of California.

G. B. D. Turner, formerly consulting engineer for India Mines Corporation, is acting in an advisory capacity in the reopening of the Eureka mine, near Hope, B. C., for General John W. Stewart and associates, of Vancouver.

L. D. Albin, formerly general sales manager of the Ingersoll-Rand Co., has been elected vice-president in charge of European sales of that company. **D. C. Keefe,** formerly assistant general sales manager, has been appointed to succeed Mr. Albin.

Ben B. Thayer, vice-president of the Anaconda Copper Mining Co., is in Butte, Mont., inspecting the mining properties of Anaconda in the Butte district. Later he will go to Anaconda and Great Falls to inspect smelters and refining works.

A. G. Burritt, mining and petroleum geologist, of Salt Lake City, Utah, has just returned from an examination of the Monte Cristo property, on Loon Creek, Custer County, Idaho, for which he will act in a consulting capacity, in addition to performing the same function for the Eureka-Nevada, at Eureka, Nev. He says that the demand for lead is causing a revival of activity in the Clayton district, and that the Lost Packer, formerly a producer of gold and silver ores, is being put in condition for operation this summer. Mr. Burritt, during the approaching season, will examine the Spring Valley Mining Co. property, in Nevada, and placer property at the headwaters of the Dirty Devil, in southern Utah. He will also work out the ore structures of western Wyoming, in Lincoln and Sublette counties, involving subsurface geological examinations, as through this region the Cretaceous is covered by the later Tertiary, presenting an interesting and intricate problem.

A. G. Burritt

J. D. Sears, administrative geologist of the U. S. Geological Survey, is in Colorado to study the geology of the northeastern part of the state in the hope of determining whether or not conditions are favorable to the occurrence of oil.

Daniel Harrington, supervising mining engineer for the Denver office of the U. S. Bureau of Mines, will leave the Bureau June 1 to accept the post of chief of the safety inspection work of the Utah Coal Co. and the United States Fuel Co. He will be succeeded by **E. H. Denny.**

Marshall D. Draper, who has just returned from China, where he spent four years in the Province of Shantung, in charge of government tin mines, is in Denver visiting old friends and acquaintances. From Denver Mr. Draper expects to go East, after which he will return to the Orient.

J. A. Bancroft, professor of geology at McGill University, will spend the summer vacation at Anyox in an endeavor to extend the known limits of the Hidden Creek ore deposit. Professor Bancroft has spent several summers in similar occupation for the Granby company.

A. Alverez Calderon, of Lima, Peru, is president and attorney for the Northern Peru Mining & Smelting Co., a subsidiary of the American Smelting & Refining Co., which has just started a new concentrating and cyaniding plant east of Trujillo, Peru, and which will build a copper smelter during the next two years.

J. Fred Johnson, who recently resigned as general superintendent of the Chief Consolidated Mining Co., of Eureka, Utah, to enter private business, is making a trip by automobile, accompanied by his family, through Arizona, California, Oregon, Washington, Idaho, and Montana, visiting various mining camps.

W. H. Schacht, of Painesdale, Mich., general manager of the Copper Range Co., and **Charles H. Baxter,** of Loretto, Mich., superintendent of the Loretto iron mine, were elected delegates to the Republican National Convention, to be held at Cleveland in June, by the Twelfth Michigan district convention at Houghton.

J. Ross Corbin, associate geologist, Pennsylvania Geological Survey, has been in Philadelphia conferring with S. M. Swaab, consulting engineer to the Mayor, the Philadelphia Water Supply Commission, and the commission's engineers relative to the geological aspects of new water supplies for the City of Philadelphia.

John Knox, general superintendent of the Calumet & Hecla Consolidated Copper Co., Calumet, Mich., has resigned and will leave about June 1 for the Porcupine district of Ontario, Canada, to become assistant general manager of the Hollinger Consolidated Gold Mines. Mr. Knox came to Calumet in 1907 as superintendent of underground operations of the Calumet conglomerate lode, succeeding **James B. Risque,** and in 1911 became general superintendent.

J. A. Spencer has gone from Australia to Papua as field manager for the British Development Co., which is the first corporation to obtain an oil concession in that country under the League of Nations mandate. Mr. Spencer in 1921 conducted a party of eight geologists of the Anglo-Persian Co. 50 miles inland in Papua over country till then totally unexplored. His present venture is in the vicinity of the Selnip River, which will be reached from the Dutch border. He is to explore further territory for oil, and manage any field operations that may be undertaken.

Obituary

William R. Todd died on May 22 in Morristown, N. J., at the age of eighty-seven. He had been president of the Quincy Mining Co. for twenty-five years, and had been identified with that company's interests for a much longer period. He is survived by three sons, William Parsons Todd being vice-president of the Quincy Mining Co. and president of W. Parsons Todd, Inc.

Societies, Addresses, and Reports

British Scientific Society to Meet at Toronto in August

Special Program Arranged for Geologists—Membership Open to All

The British Association for the Advancement of Science will hold its ninety-second annual meeting in Toronto from Aug. 6 to 13. More than 430 scientists from Great Britain and a large number of Americans will attend the convention.

The association invites to this meeting all who are interested, an annual membership being provided, for $5, which entitles the holder to admittance to any of the sectional meetings, lectures, receptions, and local excursions which are to be features of the gathering. Membership tickets and all details may be obtained from the Treasurer, British Association, Room 50, Physics Building, University of Toronto, Toronto, Ont., Canada.

Sectional meetings will be held covering the following subjects: mathematical and physical science, chemistry, geology, zoology, geography, economic science and statistics, engineering, anthropology, physiology, psychology, botany, educational science, and agriculture.

At the meeting of the geological section the president's address will be delivered by Dr. W. W. Watts, professor of geology in the Imperial College of Science and Technology, London. This will deal with economic geology, mining, and economic problems. The abbreviated program includes:

Local geology and palæontological problems. Dr. W. A. Parks will speak on "The Upper Ordovician Section at Toronto," and Dr. A. P. Coleman on "The Pleistocene of the Toronto Region." Dr. Parks will also speak on "The Dinosaurs of Alberta" and Dean G. F. Kay, Iowa, on "Gumbotil in Pleistocene Geology."

Radioactivity of the Earth's Crust and pre-Cambrian Problems. Dr. Ellsworth will speak on the radioactive minerals in pre-Cambrian formations. The climate, mineralization, and the Grenville and Huronian formations will be discussed by Profs. A. P. Coleman, of Toronto; T. T. Quirke, of Illinois; R. C. Wallace, of Manitoba, and Dr. M. E. Wilson, of Ottawa.

Papers on Economic and Mining Geology will deal with "The Direction of Cleat in Coal," by Prof. E. Moore, of Toronto: "The Structural Features of the Kirkland Lake Gold District," by Prof. A. Machean, and the "Geological Features of the Keeley Mine," by Dr. J. M. Bell and Prof. Ellis Thompson.

Joint Sectional Sessions. (1) With the chemistry section in a discussion on "Liquid and Powdered Fuels." Dr. G. S. Hume will speak on "The Liquid Fuels of Canada." (2) With the geography section, in a discussion on "Changes of Sea-level in Relation to Gravitation, Continental Shelves, and Coral Islands." Dr. A. P. Coleman will speak on "Raised Beaches as Related to the Thickness of Ice Sheets," and Dr. W. M. Davis on "An Uplifted and Beveled-off Atoll."

A popular lecture is expected from Sir Thomas Holland, head of the Imperial College of Science, London. Sir Thomas was formerly Director of the Geological Survey of India and has an international reputation.

The excursions will cover the glacial deposits and Palæozoic rocks of the Toronto districts, the Grimsby and Niagara districts, and the eastern Ontario pre-Cambrian.

J. S. Flett, Director of the Geological Survey of Great Britain and the Museum of Practical Geology, and Dr. Gertrude Elles, a former president of the section, are among those who have signified their intention to be present.

American Mining Congress Plans Special Train for Big Sacramento Meeting

The twenty-seventh annual convention of the American Mining Congress will be held this year in Sacramento, Calif., from Sept. 29 to Oct. 4. Great enthusiasm has already been shown by Western mining men, and the indications are that the convention will be the most successful yet held.

It is the earnest desire of the committee to have as large an Eastern delegation as possible, with all Eastern mining companies represented by one or more members of their organizations. To that end, a special train has been chartered which will run over the Chicago & Northwestern R.R. from Chicago to Omaha, the Union Pacific from Omaha to Denver, the Denver & Rio Grande from there to Salt Lake, and the Southern Pacific to Sacramento. It will leave Chicago at 8:15 p.m. Monday, Sept. 22, arriving at Sacramento at noon on Monday, Sept. 29. Stop-overs have been arranged for a day at Denver, with sightseeing tours and a banquet; a day at Colorado Springs, at the Broadmoor and visiting the Cripple Creek mines; a few hours at the Black Hawk coal mine, at Hiawatha, Utah; and a day at Salt Lake, with entertainment and an inspection of the Utah Copper and other properties.

Compartment and drawing-room sleepers, dining car, and club car will be carried, with valet, barber, and maid service. The round trip fare from New York will be $138 and from Chicago $86. The Pullman fare for a lower berth one way from Chicago to Sacramento is $24. The return trip may be made as one wishes, with optional routes via the Coast at slight additional expense. The return limit is Oct. 31.

Lake Superior Institute May Cross Border

The annual meeting of the Lake Superior Mining Institute is scheduled to be held on the Marquette range, early in August, but it is likely that the council of the organization will vote to take a trip to the Sudbury, Cobalt, and Porcupine districts in Ontario, Canada, making a trip of six days. A definite decision will be reached soon.

Problems of Underground Radio Not Yet Solved

The U. S. Bureau of Mines has recently published two reports concerning radio communication underground: Reports of Investigations No. 2,576, "Underground Signalling for Mines by the Ground-conduction or 'T. P. S.' Method," and No. 2,599, "Radio as a Method for Underground Communication in Mines." Many tests have been made in various parts of the country, in practically all of which the general procedure has been to take into the mine receiving sets of varying degrees of sensitivity and listen to broadcast music or speech from high-power broadcasting stations which are usually not far from the mine.

Three important factors should be noted: First, the power of the sending station is much greater than would be practicable for a mine sending set; second, in most of the tests, one-way communication only has been achieved; and third, practically all of the experimental data indicate that the radio waves do not go far through the earth but are transmitted underground by trolley wires, power and lighting circuits, car rails, compressed-air and water piping, hoisting cables, or steel framework.

Direct transmission through earth depends to a large extent on the character of the ground. Conductivity varies principally with the amount of free water present, and to a less extent on the type of ore or mineral. Coal and shale are good insulators.

The Bureau points out that the cost of radio receiving sets and the knowledge necessary to maintain and operate them make their underground installation at present hardly justifiable in view of the meager development that has so far been accomplished. But several reasons are offered why installation of the apparatus would be advisable provided it can be made sufficiently practicable to be used regularly as a means of mine communication.

Metallurgical Fellowships Established at Carnegie Tech

A definite program of investigations in metallurgy in co-operation with the U. S. Bureau of Mines was recently adopted by the Carnegie Institute of Technology in Pittsburgh as an extension of its ever-increasing field of scientific research, according to an announcement from Dr. Thomas S. Baker, president of the institution. Immediate action to start the metallurgical research has been taken by the establishing of four fellowships to begin investigations of problems in August, 1924.

The fellowships, says the announcement, will be awarded to college graduates, the appointees to register as candidates for the degree of Master of Science. Each will be paid a yearly stipend of $750.

Dr. D. A. Lyon, Chief Metallurgist of the U. S. Bureau of Mines, has assured President Baker that if sufficient encouragement were offered the Bureau would concentrate its metallurgical work on iron and steel at the Pittsburgh station.

Recent Technical Publications

Reviews, Abstracts, and References

How "The Interests" Are Organized

Corporation Finance. By Edward S. Mead. Fifth edition, revised. D. Appleton & Co., New York. Price $3.

One finishes reading this book with the distinct impression that Dr. Mead has given his subject splendid treatment. His text is elementary enough to satisfy those who have but little knowledge of corporate finance and yet comprehensive enough to give the specialist the theoretical and practical information he demands. The volume itself open with a discussion of the work of the promoter and then takes up the tools of the financier—stocks and bonds—the handling of which consumes the greater part of the book.

Not the least interesting chapter to mining men is one on "blue-sky" legislation and its spread in the United States. The author concludes that "legitimate business enterprises, no matter how hazardous, where men risk their own money in the pursuit of ends which seem to them profitable, have nothing to fear from public regulation." The scope of the text includes such topics as the functioning of holding companies, leases, open price associations, and last but not least bankruptcies and receiverships, with their attendant reorganizations. It is evident that Dr. Mead has spared no pains to bring his work up to the minute in this its fifth edition. F. E. WORMSER.

Electrometallurgy of Zinc — "Progress in the Electrometallurgy of Zinc" has been translated by B. M. O'Harra and P. Cambiaire from *La Technique Moderne*, and was published as a 13-page paper in the January issue of *Zn.* It may be obtained from the American Zinc Institute, 27 Cedar St., New York City.

Mexican Resources—The U. S. Department of Commerce, Washington, D. C., has published an exhaustive industrial and commercial survey of the Mexican West Coast and Lower California, covering particularly the natural resources of the region. The report, 340 pages, bound in buckram, may be obtained for 85c. from the Superintendent of Documents, Washington, D. C.

South Australian Mining—The Department of Mines, Adelaide, South Australia, has published a 62-page bulletin, No. 38, covering mining activities in that state for the half year ended June 30, 1923. Obtainable on request. Also, the annual report of the Director of Mines and Government Geologist for 1922, 14 pages, is now available.

California Mineral Production—The California State Mining Bureau, Ferry Building, San Francisco, has published Bulletin No. 93, 188 pages, on "California Mineral Production for 1922," by Walter W. Bradley. Much descriptive matter on the uses of the various minerals produced is included.

Powdered Coal—Bulletin 223 of the U. S. Bureau of Mines, Washington, D. C., 92 pages, is entitled "An Investigation of Powdered Coal as Fuel for Power-plant Boilers," by Henry Kreisinger, John Blizard, C. E. Augustine, and B. J. Cross. It describes tests at the Oneida Street Power Station, Milwaukee, to determine what over-all boiler efficiency could be obtained with pulverized coal under various conditions of furnace operation and with coal of different fineness and moisture content. The results showed that with reasonable care an all-over boiler efficiency of 80 to 83 per cent could be obtained. The bulletin may be obtained free from the Bureau of Mines as long as its supply last; thereafter for 15c. from the Superintendent of Documents, Washington, D. C.

Flotation—One of the best scientific discussions of the physical factors involved in flotation is that contained in Technical Paper 262, "Certain Interfacial Tension Equilibria Important in Flotation," by W. H. Coghill and C. O. Anderson, 54 pages. It may be obtained so long as the supply lasts from the U. S. Bureau of Mines, Washington, D. C.; thereafter from the Superintendent of Documents, Washington, D. C. for 10c. The first part of the paper discusses the case of two liquids and a gas in contact, and the second part bears on the phenomena when one liquid, one solid, and one gaseous substance are in contact.

Group Insurance — The remarkable growth of group life insurance, which, at the end of 1922 amounted to $1,800,000,000 and covered approximately 2,000,000 employees, is the subject of a bulletin issued by the Insurance Department of the Chamber of Commerce of the United States, Washington, D. C. The methods employed in taking out group insurance and of developing an interest in it by employees are described at length. It is regarded as playing an important part in promoting labor stability.

Ground Water—Water-supply Paper 489 of the U. S. Geological Survey, Washington, D. C., 321 pages, is a discussion of the principles of "The Occurrence of Ground Water in the United States," by O. E. Meinzer. The material is well presented and accompanied by numerous illustrations and maps. It is obtainable free from the Survey so long as its supply lasts; thereafter for 60c. from the Superintendent of Documents, Washington, D. C.

Sponge Iron—U. S. Bureau of Mines *Reports of Investigations* No. 2,579, 6 pages, describes a process for the production of sponge iron worked out at the Northwest Experiment Station of the Bureau. The authors are Clyde E. Williams, Edward P. Barrett, and Bernard M. Larsen. In contradistinction to the process used at Chino, there is direct contact between the flame used for heating the charge and the material to be reduced, a kiln similar to an ordinary cement kiln being used.

Patents

Lead-Zinc Ore Treatment—No. 1,491,653. April 22, 1924. E. A. Ashcroft, London, England. The patent covers the subjection of lead-zinc sulphide ore to the action of chloride of sulphur at a relatively low temperature.

Sintering Machine — No. 1,491,778. April 22, 1924. H. J. Stehli, Cedar Grove, N. J. A sintering machine of a type similar to the Dwight-Lloyd.

Locating Ore—No. 1,491,900. April 29, 1924. D. G. Chilson, Jerome, Ariz., assignor to the University of Arizona, at Tucson. The process of locating or exploring orebodies comprising the application of a point of contact to the earth and a second contact to a known body of ore; connecting an electromagnetic wave-producing device between the contacts; also placing one at points distant from the point of contact with the known body of ore; and determining the presence or absence of ore adjacent to such distant points by the intensity of the electro-magnetic waves.

Ore Reduction—No. 1,491,960. April 29, 1924. Emil Mill, Los Angeles, assignor of one-half to A. L. Gray, Los Angeles. A retort furnace adapted for treating ore with a carbonaceous gas.

No. 1,492,286. April 29, 1924. G. H. Clevenger, Boston, assignor to Research Corporation, New York. A method of reducing ores by treatment in revolving kilns with reducing gases.

No. 1,492,502. April 29, 1924. C. E. Wuensch, Golden, Colo. A tube furnace, with suitable means for feeding, heating, and delivering the charge.

Electric Furnace—Nos. 1,492,086 and 1,492,087. April 29, 1924. J. F. Shawhan, Dayton, Ohio, assignor of one-half to P. L. Sagebiel, Dayton. An electric furnace adapted for pyritic smelting of ores.

Metal Precipitation — No. 1,492,282. April 29, 1924. F. M. Becket and A. L. Field, New York, assignors to Union Carbide & Carbon Research Laboratories, Inc., New York. The process of precipitating heavy metals from their alkaline solutions by the use of an alloy of silicon and an activating metal.

No. 1,492,283. April 29, 1924. F. M. Becket, New York, assignor to Union Carbide & Carbon Research Laboratories, Inc. Same as above except that the precipitating agent is silicon metal.

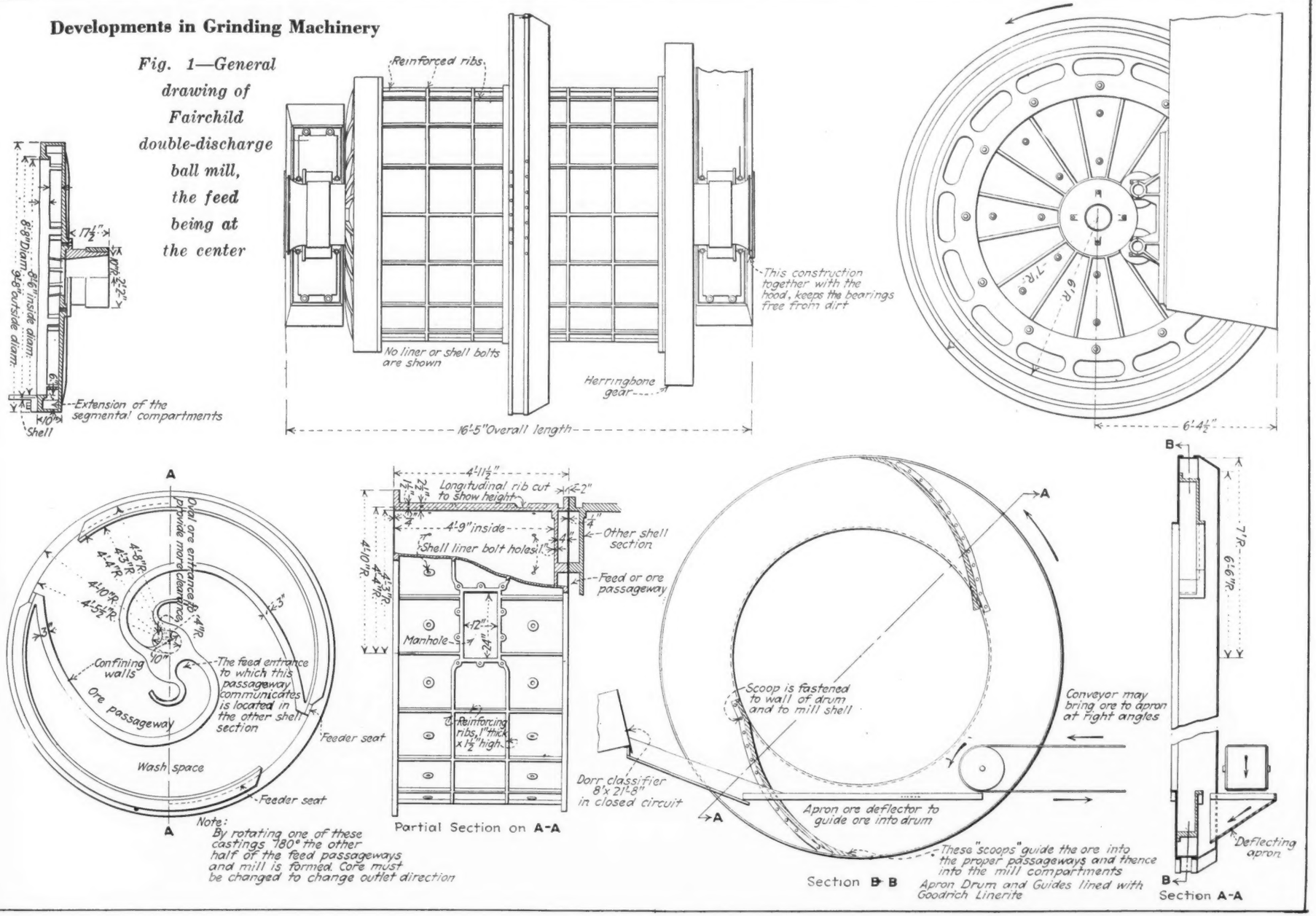
Concentrating Process—Nos. 1,491,110 and 1,491,111. April 22, 1924. Charles Spearman, Westmount, Que., Canada. A method of grinding ore, and agglomerating and floating the mineral particles.

Screen — No. 1,491,432. April 22, 1924. A. H. Stebbins, Los Angeles. A vibrating screen actuated by an unbalanced pulley.

Electrolysis — No. 1,491,498. April 22, 1924. U. C. Tainton, Johannesburg, Transvaal, South Africa. In the electrolysis of aqueous solutions with insoluble anodes, the patent covers the surrounding of the anode with a solution containing 10 per cent or more of free acid, and the use of a current density of 50 amperes or more per square foot of anode surface.

Developments in Grinding Machinery

Fig. 1—General drawing of Fairchild double-discharge ball mill, the feed being at the center



New Machinery and Inventions

Developments in Grinding Machinery

Increased Capacity and Greater Flexibility Claimed for New Double-Discharge Ball Mill

THE development of the well-known types of ball mills during the last few years has produced several efficient machines for the physical reduction of materials. With the exception, possibly (under some conditions), of the rod mill, the ball mill has been the most efficient grinding machine produced.

Recently the introduction of a new factor has resulted in the development of the Fairchild "double-discharge" ball mill. This new factor is a means by which ore is introduced into two separate compartments having a common axis of rotation.

Fig. 1 (page 904) illustrates the construction of a No. 84½ mill. The grinding compartments are, in this instance, shorter than in the usual ball mill, each being 8 ft. in diameter and 4½ ft. long inside of the liners. Features are the quick method of ore admission and the method by which the grates in the discharge heads are kept at as near 100 per cent efficiency as possible.

Fig. 2 illustrates the construction of the discharge head compared with those of other types of grate or quick-discharge mills. It will be seen, Fig. 2*a*, that the material that passes through the grates in the older types of mills tends to rise in the segmental compartment, blinding slot after slot as the hydrostatic heads within the grinding compartment and the segmental compartments approach one another. This decrease of discharging efficiency slows up the rate at which the mill content is changed and thereby limits the capacity of the mill, particularly when doing closed-circuit grinding. That this condition cannot exist in the new mill is apparent from Fig. 2*b*. The "pockets" or extensions of the segmental compartments below the grates tend to keep the grate slots at highest discharging efficiency and cause a more rapid change of mill content.

In operation, the Fairchild mill takes its feed at right angles to its axis of rotation. The ore may be brought to the mill by belt conveyor, or other means, and dumped into a feed apron, which deflects it at right angles into the feed drum, which is fastened to the mill shell and rotates about the apron. Within the feed drum are two "scoops" or, preferably, spiral guides, located diametrically opposite each other. These guides do not "gouge" the ore in any sense, but merely guide it into two spiral passageways which are midway between the two discharge heads, from which it enters one or the other of the grinding compartments near the axis of rotation.

The two separate grinding compartments in the mill produce the effect of two mills, but save floor space and reduce power and ball and liner costs, and, with the center feed feature, permit a more efficient and economical arrangement with other equipment than has heretofore been possible.

A double mill having compartments

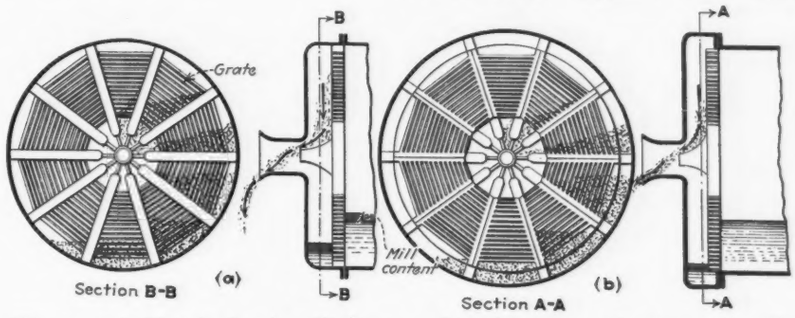


Fig. 2—(a), Sketch showing discharge end used in some other types of mill. (b), Discharge end of Fairchild mill.

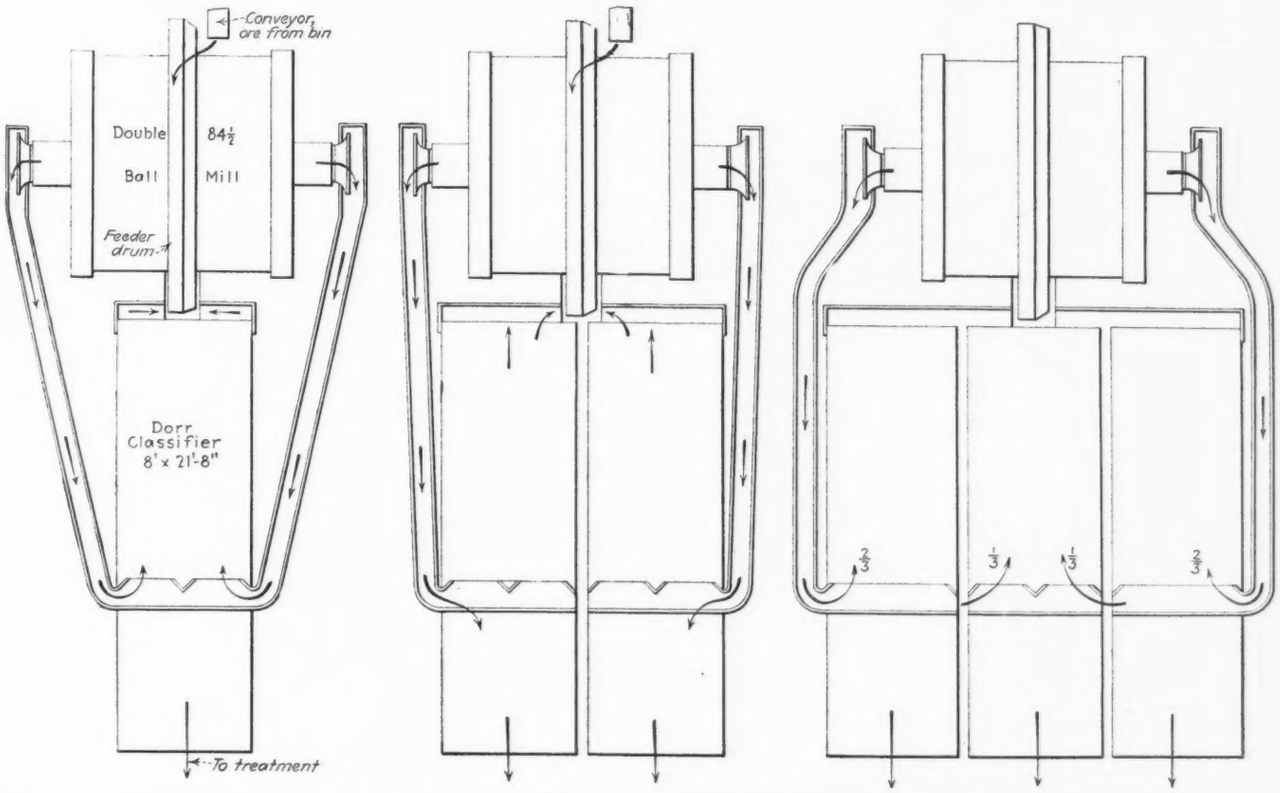


Fig. 3—Sketch illustrating mill and classifiers in closed circuit, with one, two, and three classifiers

each 8 ft. in diameter by 4½ ft. long occupies practically the same floor space as the usual 8x6-ft. ball mill. The double mill, however, has 50 per cent greater total grinding compartment length. This fact alone indicates a greater capacity.

It is believed that, under identical conditions, and given ample classifier capacity in closed circuit, the capacity of one 8x4½-ft. grinding compartment should be above 85 per cent of the capacity of one that is 8x6 ft. If this is correct, not less than 70 per cent more capacity may be expected from two such 8x4½-ft. grinding compartments than may be obtained from one 8x6-ft. compartment under identical conditions.

The one 8x6-ft. grinding compartment would have, say, 100 per cent discharge area, and, similarly, the two 8x4½-ft. compartments would have a total discharge area of 200 per cent. Of this 200 per cent discharge area 150 per cent would, normally, care for the discharge of the two grinding compartments, based on 100 per cent discharge area for the single 8x6-ft. unit. The effect of the extra 50 per cent of discharge area is thus distributed and would tend to increase the speed at which the mill content is changed.

The figures given are based on discharge means of equal efficiency. Owing to the fact that the slots of the grates of the double mill are unobstructed, as explained, and the grates, therefore, more efficient, the speed with which the mill content is changed would be even more rapid, and, in closed circuit with ample classifying apparatus, a considerable increase in tonnage would result.

Fig. 3 illustrates a few closed circuits with Dorr classifiers, the construction of this mill readily permitting the use of from one to four such classifiers. The fact that no scoops are necessary at any point in any of the closed circuits greatly simplifies the arrangement.

The construction of the new type of mill permits of greater flexibility and adaptability than does that of other mills, owing to the fact that a great variety of capacities may be had from a given diameter of mill by changing the length of the two shell sections. Metallurgical requirements may also be met with greater ease in this same manner. For example, if properly operated, a mill with two exceptionally short grinding compartments having a large diameter would produce a granular product. The same results could be obtained with a single-compartment mill in all probability, but only at a greater cost per ton.

The safe, dependable operation of any mill is a direct function of its bearings. To secure and insure good performance for Fairchild mills, the entire rotating load and gear loads are carried on Hyatt high-duty roller bearings. The bearing sizes and types selected in the design of these mills give a safe overload capacity of 30 per cent. By substituting rolling action for sliding friction it is reasonable to expect an appreciable saving in power, but, no less important, are absence of bearing trouble and freedom from constant attention. The bearing housings are so designed as effectively to exclude all foreign material from the bearings and likewise to retain the lubricant. This is a factor that makes for long life and also represents a real saving in maintenance and also in lubrication costs.

The Hyatt bearing is peculiarly adapted to this type of service, because of the inherent resilience of the rollers. This resilience, though only microscopic in magnitude, insures full line contact of the rollers and prevents permanent deformation of the rollers under shock loads. A cast-iron hood incloses each assembly of bearings and trunnions in an effective manner to exclude splash and foreign material.

The Hum-mer Screen

In the article entitled "Concentrator Snapshots," by E. H. Robie, which appeared in the *Mining Journal-Press* of April 12, an error was made in the statement that the Hum-mer screen is vibrated "through a shaft driven by a small electric motor." The vibration is really imparted to the screen surface by a simple alternating-current magnet, and there are no bearings or revolving parts. It has also been pointed out by the manufacturers that their mechanically vibrated screens with drumhead tension of the screen cloth were in operation in quite a number of mills in the West as early as 1916, and that the Hum-mer type of electrical vibration was installed on machines of the Utah Copper Co. prior to the design of a competing type by one of the employees of that company.

A New Tractor Loader

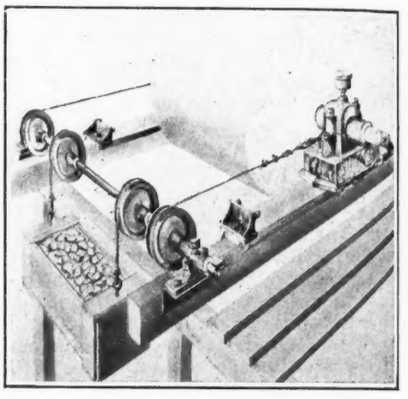
A new portable elevator loader, so designed as to overhang the tractor that moves it about, has recently been introduced. The tractor also furnishes the power required for operating the loader. The loader has three main parts: supporting frame, elevator, and belt conveyor, as shown in the accompanying cut. The elevator on the rear is set at the proper angle for efficient work. The steel buckets are operated by endless chains and work on rollers, the latter being a special feature of this loader.

The frame consists of four uprights attached to the tractor. About two hours is needed to set up. The rear uprights end in cast-steel saddles strapped around the rear axles. The front uprights are bolted to the radiator.

The loader is operated from the power take-off shaft of the tractor, a sprocket wheel being attached to the shaft. All the power that the engine affords for belt work is available for operation. The loader is made by the Specialty Engineering Co., Allegheny and Trenton Aves., Philadelphia, Pa.

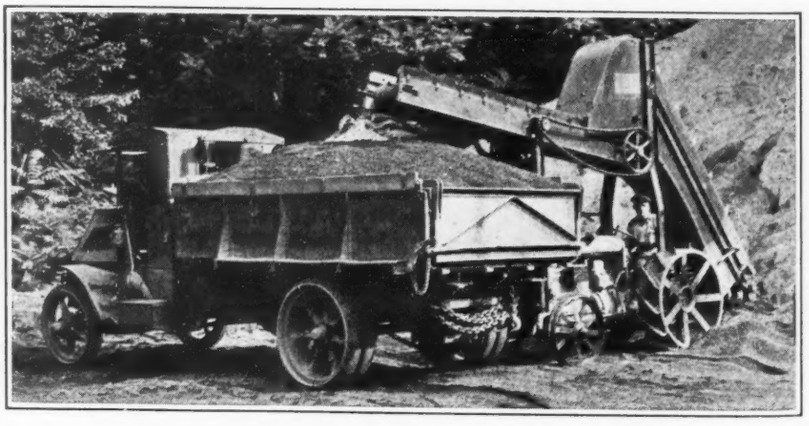
Automatic Take-Up for Conveyor Belts

A take-up for conveyor belts has been designed so as to adjust itself automatically to operating conditions. The pull it exerts is directed over the full width of the belt. This action is obtained by the use of two cables, each attached to one side of the tail pulley of the conveyor and anchored direct to separate sheaves keyed to a shaft mounted in a permanent position. One of these cables is fitted with a turnbuckle to adjust the pull equally in both cables. A weight hangs from another pair of sheaves keyed to the shaft mentioned. The travel provided is ample, but is limited between stops, and the moving bearings are fitted with safety clips, which are introduced to prevent lifting.



This device automatically takes up slack in conveyor belts

The new take-up is a device of the Merrick Scale Co., with offices at Passaic, N. J.



A portable loader of unique construction

The Market Report

Daily Prices of Metals

May	Copper, N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
22	12.50@12.625	40.25	40.75	6.90	6.65	5.65
23	12.375	39.50	40.00	6.85	6.50@6.625	5.60@5.65
24	12.375@12.50	39.75	40.25	6.85	6.50@6.625	5.60@5.65
26	12.375@12.625	40.50	41.00	6.90	6.70	5.65
27	12.50	41.00	41.50	6.95	6.70	5.75@5.875
28	12.50	41.50	42.00	7.00	6.75	5.80@5.875
Av.	12.479	40.417	40.917	6.908	6.654	5.70

*These prices correspond to the following quotations for copper delivered: May 22d, 12.75@12.875c.; 23d, 12.625c.; 24th, 12.625@12.75c.; 26th, 12.625@12.875c.; 27th and 28th, 12.75c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Engineering and Mining Journal-Press* and a special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

London

May	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
22	61¼	62⅛	66½	206	205½	29	27⅞	30⅜	30⅜
23	60⅝	61¾	66½	201	200½	28⅝	27½	30¼	30¼
26	61⅛	62	66½	206¾	206¼	29⅞	27¾	30⅝	30⅝
27	61¼	62⅛	66¾	208½	207	29¾	28	31⅛	31⅛
28	61⅝	62½	66¾	213¼	211½	30	28⅛	31⅝	31½

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

May	Sterling Exchange "Checks"	Silver		Gold London	May	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
22	4.35	66⅞	34 9/16	94s 8d	26	4.34½	66¼	34 5/16	94s 11d
23	4.33⅝	66½	34½	95s 0d	27	4.33½	66⅛	34 5/16	95s 0d
24	4.34¼	66⅜	34 7/16	.....	28	4.33	66¼	34 7/16	95s 2d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-quarter of a cent premium.

Metal Markets

New York, May 28, 1924

The slump in the non-ferrous metal markets seems to have culminated on Friday and Saturday, when new low prices were registered for practically all of the more important metals. Since then, a pronounced reaction has set in, copper, lead, zinc, and tin all being stronger.

The reason to be assigned to the upward tendency is not altogether clear; it seems to have been inspired from London, all the cables being higher on Monday morning, with further advances yesterday and today. There is also perhaps a feeling that Congress has done its worst and that the discouraging news from Washington is about at an end. Traders have aided the market reaction by buying substantial quantities of all the metals, thus eliminating those held by weak interests. Silver has acted independently of the other metals recently; on last Tuesday, the price of this metal reached 66⅞c., the highest level for a year.

Copper

The bargain prices at which copper was offered by some interests culminated on Friday, when a substantial tonnage was sold for 12½c. delivered, Valley. Most other sellers were able to get 12⅝c. for smaller quantities, and up to 12⅞c. was secured in some instances for the more distant deliveries. On Monday, a little copper was still available at 12⅝c. delivered, but this was quickly absorbed, and yesterday and today practically all producers were asking 12⅞c., with a fair amount of business done at that level. Most of the larger producers at least are well sold up and are not disposed to cut prices below the general level. They have had little prompt copper to sell, and are not disposed to book business very far into the future at the prices now current. Some copper has been sold for August at 12⅞c. in the last day or two, but most sellers are asking 12⅞c. for deliveries as far ahead as that month. One or two producers are entirely out of the market for any delivery.

The foreign sales have not been particularly encouraging, but the business has been sufficient to take any pressure off the domestic market that might otherwise have ensued. The prices have netted producers here around 12.75c., f.a.s., during most of the week.

Lead

The official contract price of the American Smelting & Refining Co. was reduced from 7.25 to 7c. on Thursday, May 22. As with the other metals, the price of lead slumped further and then has recovered in the last two or three days. Immediately upon the announcement of the Smelting company's reduction, other sellers offered lead at 6.90c., New York, and some was sold as low as 6¾c. on Friday. On Saturday, Monday, and Tuesday, from 6.80 to 6⅞c. was realized, but we are unable to learn of anything available under the 7c. level today. Inquiries have been very numerous with the greater show of strength, and many have developed into orders, though consumers are not buying large tonnages. The Middle Western producers are actively competing for business in the East, as consumption in the West has not been particularly good lately. Two large lots were marketed on Friday and Saturday at 6½c., St. Louis, but this metal was not taken by consumers.

The slump in the sales of automobiles will of course affect the amount of lead required by storage-battery makers, but it is too early yet to say just how important this will be. Most other outlets of lead are flourishing.

Zinc

Zinc sold quite freely, or at least was freely offered, at 5⅝c. on Friday and Saturday, without causing a stampede at the doors of sellers. The demand for the metal from galvanizers seems to have petered out almost entirely lately. On Monday, sellers were encouraged by the strength in London, and as some zinc was being accumulated by traders and dealers, an upturn in prices occurred here. Today small

lots of prompt zinc could be obtained for 5.80c., but the price was around 5⅞c. for July and August, some sales for those months being made. The brass manufacturers have taken a little more interest in the metal, but it is largely the high-grade that is required by them. This continues to be sold at from 7⅞@8¼c., delivered.

Tin

Tin prices are higher again, but Straits got as low as 40c. for spot metal on Friday. Consumers continue to take only modest amounts, and the London advance seems to have been made without the aid of much American support. There is now no particular scarcity in spot metal, and the price asked for deliveries three months hence is only about one-quarter of a cent less than for prompt deliveries.

Arrivals of tin in the United States to May 27 total 4,680 long tons, according to the New York Metal Exchange.

Foreign Exchange

Nothing indicates any special effort to regulate sterling exchange, and it will no doubt be allowed to seek its own level until there is more currency stability in Europe. It is held that it could easily be sent to parity by economic measures should it seem expedient to do so. Closing cable quotations on Tuesday, May 27, were as follows: francs, 5.365c.; lire, 4.405c.; and Canadian dollars, 1⅛ per cent discount.

Silver

The decline in both London and New York prices during the week was due chiefly to a lessened demand for the Continent and reported selling for China account, with a sharp decline in sterling exchange rates.

Mexican Dollars—May 22d, 51⅛; 23d, 50⅞; 24th, 50⅝; 26th, 50½; 27th, 50½; 28th, 50½.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—99 per cent grade, 28@29c. per lb.; 98 per cent, 27@28c. London, £125 per long ton.

Antimony—Per lb.:
Chinese and Japanese brands, 8½c.
W. C. C. brand, 11c.
Cookson's "C" grade, 12½c.

Chinese needle, lump, nominal, 8½@9c.

Bismuth—$2.35@$2.40 per lb. London, 10s.

Cadmium—60c. per lb. London, 2s. 6d.

Cobalt—$2.50@$3 per lb. for spot.

Iridium—$260@$270 per oz.
Iridium alloyed with platinum, $280@$286.

Nickel—27c. per lb. for 99 per cent virgin metal. London, £135 long ton.

Osmiridium—Crude, $58.50 per oz.

Osmium—$98@$108 per oz.

Palladium—$78@$83 per oz. Crude, $60 per oz.

Platinum:
Refined, $116 per oz.
Crude, $112@$114 per oz.

Quicksilver — $75@$77 per 75-lb. flask. San Francisco wires $72.65; London, £13¼.

Rhodium—$85@$90 per oz.

Ruthenium—$40@$45 per oz.

The prices of **Magnesium, Molybdenum, Monel Metal, Radium, Selenium, Tellurium, Thallium, and Tungsten** are unchanged from prices given in May 3 issue.

Metallic Ores

Chrome—$19@$22, depending upon grade and source. Nominal.

Manganese—42@46c. per long ton unit, seaport, c.i.f. Nominal.

Molybdenum—80c. per lb. of MoS_2 for 85 per cent concentrates. Nominal.

Tungsten Ore—Per unit, N. Y.
High-grade wolframite, $9@$9.25.
High-grade scheelite, $9.25.
Ordinary grades, $8.60@$8.75. Nominal.

Iron Ore, Magnetite, Tantalum, and **Vanadium** are unchanged from May 3 quotations.

Zinc and Lead Ore Markets

Joplin, Mo., May 24—Zinc blende, per ton, high, $41.65; basis 60 per cent zinc, premium, $40; Prime Western, $39@$38; fines and slimes, $38@$36; average settling price, all grades of zinc, $37.13.

Lead, high, $101.50; basis 80 per cent lead, $77.50; average settling price, all lead ores, $85.87 per ton. Very little lead is selling on the basis offerings the last three weeks. Settlements are still being made on ore contracted for on a basis of $120 per ton.

Shipments for the week: Blende, 10,425; lead, 1,198 tons. Value, all ores the week, $489,950.

Sellers realize metal producers cannot profit on present ore prices; neither can they profit on present ore prices, and consequently little ore is offered for sale. Such sales as are being made are mostly by companies not strong enough to hold their output.

More mines were closed down last night, making a total restriction of approximately 3,000 tons per week.

Platteville, Wis., May 24—Blende, basis 60 per cent zinc, $42 to $42.50 per ton. Lead, basis 80 per cent lead, $80 per ton. Shipments for the week: Blende, 660 tons; lead, 30 tons. Shipments for the year: Blende, 10,556; lead 382 tons. Shipments for the week to separating plants: 955 tons blende.

Non-Metallic Minerals

Asbestos:
Crude No. 1—$300@$400.
Crude No. 2—$175@$225.
Spinning fibers—$90@$150.
Magnesia and compressed sheet fibers—$60@$90.
Shingle stock—$50@$70.
Paper stock—$35@$40.
Cement stock—$20@$25.
Floats—$10@$12.
All per short ton, f.o.b. mines, Quebec, tax and bags included.

Diatomaceous Earth—Per ton, f.o.b. plant, California:
Powder, insulation, $30.
Aggregate, natural, $20.
Aggregate, calcined, $50.
Brick, kiln fired, $60.
Filtration powder, $30.

Barytes, Bauxite, Beryl, Borax, Chalk, China Clay, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Gypsum, Ilmenite, Limestone, Magnesite, Manjak, Mica, Monazite, Ocher, Phosphate, Pumice, Pyrites, Rutile, Silica, Sulphur, Talc, Tripoli and Zircon are unchanged from May 3 prices.

Mineral Products

Arsenious Oxide (white arsenic)—One producer sold a good tonnage during the week, but conditions in the trade remain exceedingly quiet. The boll weevil has not yet appeared to any extent, and the calcium arsenate which has been prepared for his nourishment rests on the dealers' shelves. Until this is moved there is little likelihood of any demand for white arsenic from insecticide manufacturers. We quote the market at 9c. Some producers are nominally asking 10c., but Japanese arsenic will not bring more than 8½c. This grade, although not so good as the domestic, is satisfactory for most purposes; the chief difficulty in using it is the disposal of the containers. Some users have been compelled to go to the expense of digging a hole and burying them.

Copper Sulphate—4.60@4.70c. per lb. Demand recently improved.

Potassium Sulphate, Sodium Sulphate, Sodium Nitrate and **Zinc Oxide** are unchanged from the May 3 prices.

Ferro-Alloys

Ferrochrome, Ferromanganese, Ferromolybdenum, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferro-uranium and Ferrovanadium are unchanged from the prices given in the May 3 issue.

Metal Products

Copper—Sheets, 20¼c. base; wire, 15¼c.

Lead Sheets—Cut, 11c.; full, 10⅜c. per lb.

Nickel Silver—18 per cent Grade A sheets, 26¼c.

Yellow Metal—Dimension sheets, 17⅜c.; rods, 14⅜c.

Zinc Sheets—Base price, $9.50 per 100 lb., f.o.b. plant.

Refractories

Bauxite Brick, Chrome Brick, Firebrick, Magnesite Brick, Magnesite Cement, Silica Brick and **Zirkite** are unchanged from the May 3 prices.

The Iron Trade

Pittsburgh, May 27, 1924

The outstanding feature of the steel situation is the good progress in liquidation. The great decrease in the rate of steel production, which is now barely more than 50 per cent of capacity, while at the peak rate early last March it was 95 per cent of capacity, denotes in only small degree a decrease in consumption, but in large degree liquidation by buyers. Bars, shapes, and plates continue steady at 2.20c. to 2.30c., Pittsburgh, in territory controlled by Pittsburgh basing. Sheets are a trifle steadier. Wire products are at $2 a ton under old prices, and pipe is maintained at old prices.

Pig Iron.—Foundry iron has gone frequently at $20.50, Valley, which is now the principal figure, but the old price of $21 is often obtained on carloads. Pretense of quoting basic at $21, Valley, has practically disappeared, it being known that $20 could be done. Bessemer remains at $22, Valley.

Connellsville Coke.—Furnace coke prices have slipped farther, spot going to $3.30, and a contract for 10,000 to 12,000 tons monthly, June, July and August, has been made at about $3.40. Foundry coke remains at $4.50 to $5, but will probably sag off.

Current Prices of Mine Materials and Supplies

RISE AND FALL OF THE MARKET

The price trend of mine materials and supplies is downward. A few slight advances occurred during the month, however, which amounted to little more than local price adjustments. Railroad spikes and hydrated lime rose slightly in San Francisco; linseed oil in New York; manila rope in Atlanta and dynamite in New Orleans. Steel structurals declined 5c. per 100 lb. at New York warehouses since April 26, reflecting downward trend at mills.

SHEETS—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	St. Louis	Chicago	San Francisco	New York
No. 10	$2.80@3.00	$4.10	$4.00	$5.00	$4.14
Black					
No. 28	3.85	5.00	4.70	5.80	4.85
Galvanized					
No. 28	$4.80@5.00	6.00	5.60	6.50	5.85

STEEL RAILS—The following quotations are per ton f.o.b. Pittsburgh and Chicago for carload or larger lots:

	Pittsburgh Current	Pittsburgh One Year Ago	Birmingham	Chicago
Standard bessemer rails	$43.00	$43.00		$43.00
Standard openhearth rails	43.00	43.00	$43.00	43.00

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh Current	Pittsburgh One Year Ago	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, ⅜-in. and larger	$3.00	$3.15	$3.00	$3.85	$4.85	$3.72
Track bolts	4.00@4.25	4.00@4.50	4.00	3.90	5.85	4.57
Standard section angle bars	2.75	2.75	2.75	3.45	4.00	3.20

STRUCTURAL MATERIAL—Following are base prices f.o.b. mill, Pittsburgh and Birmingham together with quotations per 100 lb. from warehouses at places named:

	Pittsburgh, Mill	Birmingham Mill	New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	$2.10@2.25	....	$3.59	$4.40	$3.45	$3.30	$3.60
Channel, 3 to 15 in.	2.10@2.25	....	3.59	4.40	3.45	3.30	3.60
Angles, 3 to 6 in., ¼ in. thick	2.10@2.25	....	3.59	4.40	3.45	3.30	3.60
Tees, 3 in. and larger	2.10@2.25	....	3.59	4.40	3.50	3.30	3.60
Plates	2.10@2.25	....	3.59	4.40	3.45	3.30	3.60

WIRE ROPE—Discounts from list price, f.o.b. New York and east of Missouri River, on regular grades of bright and galvanized are as follows:

Hercules red strand, all constructions	20%
Cast steel round strand rope	20%
Galvanized steel rigging and guy rope	7½%
Round strand iron and iron tiller	5%
Plow steel round strand rope	35%
Special steel round strand rope	30%

	New York	Cleveland	Chicago
Drill Rod (from list)	60%	40@55%	50%

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

	Steel Inches	Steel Black	Steel Galv.	Iron Inches	Iron Black	Iron Galv.
BUTT WELD—	⅛ to 3	62	50½	¼ to 1¼	30	13
LAP WELD—	2½ to 6	59	47½	3 to 6	28	13

STEEL PIPE—From warehouses at the places named the following discounts hold for steel pipe:

	Black New York	Black Chicago	Black St. Louis
2½ to 6 in. lap welded	44%	47%	46%

CAST-IRON PIPE—The following are prices per net ton for carload lots:

	New York Current	New York One Year Ago	Birmingham	Chicago	St. Louis	San Francisco
6 in. and over	$61.60@63.60	$58.50	$48@49	$57.20@60.20	$54.60	$60.00

Nuts—	New York	Cleveland	Chicago
Hot pressed, sq., per 100 lb. Off list	$1.50	$4.00	$3.50
Cold punched, sq., per 100 lb. Off list	1.50	4.00	3.50

HOLLOW TILE—Price per block in carload lots to contractor for hollow building tile.

	New York Current on Trucks	New York One Year Ago	Chicago	Philadelphia	St. Louis	San Francisco	Perth Amboy N. J., Factory
4x12x12	$0.1162	$0.1573	$0.064	$0.125	$0.078	$0.108	.....
6x12x12	.1743	.2097	.088	.....	.106	.156	.....
8x12x12	.2179	.2621	.12	.215	.14	.244	.....

MACHINE BOLTS—	New York	Cleveland	Chicago
½ and 1¼x3 in. up to 12 in.	15 %	60%	50%

LUMBER—Prices of rough Douglas Fir No. 1 common, in carload lots to dealers in yards at San Francisco. To contractors, $2 per M. ft. additional.

	6-8 and 12 Ft.	10-16-18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft.
3x3 and 4	$35.00	$36.00	$37.00	$40.00
3x6 and 8	35.00	36.00	37.00	40.00
4x4-6 and 8	35.00	36.00	37.00	40.00

Wholesale prices to dealers of long leaf yellow pine. To contractors in New York City, delivered from lighters or cars to job, $5 additional.

	New York 20 Ft. and Under	New York 22-24 Ft.	Chicago 20 Ft. and Under	Chicago 22-24 Ft.
3x4 to 8x8	$43.00	$44.00	$41.50	$43.50
3x10 to 10x10	48.00	49.00	46.50	48.50
3x12 to 12x12	55.00	56.00	53.50	55.50

Other Cities	8 x8-In. x 20 Ft. and Under Pine	Fir*	Hemlock	Spruce	12 x 12-In. 20 Ft. and Under Pine	Fir*
Boston	$57.00	$66.00†	$51.00	$51.00	$73.00	$88.00†
Cincinnati	40.00	74.00	74.00	88.00	44.00	78.00
Denver	.....	40.75	40.75	40.75	.....	49@53
Minneapolis	42.00	41.75	40.00	.....	45.10	42.75
Kansas City	43.50	48.50	.....	.....	54.50	49.50
Birmingham	25@28	.....	.....	.....	29@32	.....

* Douglas fir. † Prime.

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh, Mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	$3.00	$3.80	$4.10	$4.55	$3.34	$4.95
Cut	3.15@3.25	4.45	5.25	5.75	3.59	5.00

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots *without bags*. Cash discount not deducted.

	Current	One Month Ago	One Year Ago
NewYork, del. by truck	$2.50@2.60	$2.50@2.60	$2.70@2.80
Chicago, f.o.b.	2.20	2.20	2.20
Cleveland, f.o.b.	2.39	2.39	2.46

LIME—Warehouse prices:

	Hydrated, per Ton Finishing	Hydrated, per Ton Common	Lump, per Barrel Finishing	280-lb. net Common
New York	$18.20	$13.10	$3.75	$3.00@$3.25
San Francisco	22.60	.....	.....	(180-lb net) 2.10

LINSEED OIL—These prices are per gallon:

	New York Current	New York One Year Ago	Chicago Current	Chicago One Year Ago
Raw in barrel (5 bbl. lots)	$0.98	$1.16	$0.94	$1.25

WHITE AND RED LEAD—In 100-lb. kegs, base price in cents per pound:

	Dry Current	Dry 1 Yr. Ago	In Oil Current	In Oil 1 Yr Ago
Red	15.00	14.50	16.50	16.00
White	15.00	14.50	15.00	14.50

HOSE—

	Fire	50-Ft. Lengths
Underwriters' 2½-in. coupled		61c per ft.

	Air—Best Grade			
¾-in., per ft.	3 ply	$0.36	4 ply	$0.44½

Steam—Discounts from List

First grade	30%	Second grade	40%	Third grade 40-5%

RUBBER BELTING—The following discounts from list apply to transmission rubber and duck belting:

Competition	50%	Best grade	50-5%

LEATHER BELTING—List price, 2c. per sq. in. per ply.

Grade	Discount from list
Medium	40-2½%
Heavy	30-5%

RAWHIDE LACING—For cut, best grade, 45-5%, 2nd grade, 55%. For laces in sides, best, 41c. per sq.ft.; 2nd, 37c. Semi-tanned: cut, 45-5%; sides, 41c. per sq.ft.

PACKING—Prices per pound:

Rubber and duck for low-pressure steam, ½ in.	$0.90
Rubber sheet	.45
Rubber sheet, wire insertion	.70

MANILA ROPE—Per lb., ¾-in. and larger, 1,200-ft. coils.

Atlanta	$0.24	New Orleans	$0.17½
New York	.19½	Seattle	.18
Chicago	.18	San Francisco	.17

EXPLOSIVES—Prices per pound of dynamite in small lots:

	Gelatin 40%	Gelatin 60%
New York	$0.27	$0.295
Minneapolis	.1917	.2123
Denver	.2025	.2275
Seattle	.165	.19
Cincinnati	.2125	.2325
New Orleans	.235	.29
San Francisco	.1625	.1925

FLOTATION OILS—All prices are per gal. in carload lots; 50-gal. bbls., gross weight 500 lbs.

Pine oil, steam dist., f.o.b. New York	$0.65
Pine tar oil, ref. f.o.b. New York	.50

CHEMICALS—

Zinc dust, 550 lb. casks, f.o.b. Palmerton, Pa., per lb.	$0.09½
Litharge, delivered New York, casks, 500 lb. lots, per 100 lb.	11.50
Sodium cyanide, 220 lb. single case lots, f.o.b. New York, per lb.	.19@.22

Company Reports

Utah Copper Co.

Earnings of Utah Copper for the first quarter of 1924 were $2,132,244.28, as shown below. The total net production of copper from all sources was 55,449,276 lb., an increase of 140,516 lb. compared with the output of the previous quarter.

During the quarter the Arthur plant treated 1,519,400 dry tons of ore and the Magna plant 1,714,900 dry tons, a total for both plants of 3,234,300 dry tons of the same average grade of ore milled during the previous quarter—namely, 1.08 per cent copper.

The average cost per pound of net copper produced, including depreciation of plant and equipment and all fixed and general expenses and after crediting gold, silver and miscellaneous earnings, was 9.12c., compared with 9.08c. for the preceding quarter computed on the same basis. The value of gold and silver recovered and the miscellaneous earnings amounted to 1.08c. per lb. of copper, as compared with 1.05c. for the previous quarter.

The following tabulation shows financial results:

	First Quarter, 1924	Fourth Quarter, 1923
Net profit from copper production	$1,719,714.44	$1,827,869.32
Miscellaneous income, including gold and silver	596,989.73	579,196.57
Bingham & Garfield Ry. Co. dividend	100,000.00	100,000.00
Total income	$2,416,704.17	$2,507,065.89
Depreciation	284,459.89	339,998.73
To surplus	$2,132,244.28	$2,167,067.16

Earnings for the first quarter are compared on the basis of 12.782c. per pound carrying price for copper, compared with 12.807c. for the fourth quarter of 1923.

A quarterly distribution to stockholders of $1 per share was made on March 31, 1924, and amounted to $1,624,490.

The total capping removed during the quarter was 904,000 cu.yd., compared with 708,600 cu.yd. for the previous quarter.

Despite the fact that the remodeled Magna mill was practically complete at the first of the year, the copper output for the quarter was not materially increased. This was due to severe climatic conditions.

Nevada Consolidated Copper Co.

Earnings of Nevada Consolidated for the first quarter of 1924 were $150,429.72. Production of copper for the quarter was 18,334,857 lb., compared with 17,853,719 lb. for the preceding quarterly period.

A total of 841,400 tons dry weight of Nevada Consolidated ore, averaging 1.27 per cent copper, was milled, and 10,027 dry tons of Ruth mine direct-smelting ore, averaging 6.92 per cent copper, was shipped to the smelter. Besides the company ores received, 4,508 dry tons of direct-smelting custom ores was received and treated at the smelter.

The cost of production, including charges for depreciation of plant and equipment and all fixed and general expenses, and after credit for gold and silver values and miscellaneous earnings, was 11.31c. per lb. of copper produced, as compared with a 10.95c. per lb. cost, similarly computed, for the preceding quarterly period.

The financial outcome of operations is:

	First Quarter, 1924	Fourth Quarter, 1923
Operating gain from production of copper	$199,610.82	$198,423.61
Value gold and silver and miscellaneous earnings	213,849.34	264,356.90
Nevada Northern Ry. Co., dividend	150,000.00	.....
Total income	$563,460.16	$462,783.51
Plant and equipment depreciation	150,429.72	131,530.05
Increase in earned surplus	$413,030.44	$331,253.46

Earnings for the quarter are based upon an average carrying price of 12.747c. per lb. of copper, compared with 12.81c. for the fourth quarter of 1923.

Construction has been confined to the installation of machinery in the third unit of the concentrator, foundations for coarse-crushing plant, smelter crushing plant addition and minor changes in the mill flow sheet, with the view of better metallurgy—all of which is progressing satisfactorily.

Noranda Mines, Ltd.

Gold; Rouyn District, Quebec

The first annual report of Noranda Mines, Ltd.—for 1923—gives the following balance sheet as of Dec. 31, 1923.

Balance Sheet as of Dec. 31, 1923

Assets(a)			
Current assets			$191,614.71
Capital expenditures			
Property		$87,169.61	
Stock in other companies (cost).			
Continental Mines, Ltd	$1,875.00		
Anglo Porcupine Gold Mines, Ltd.	14,023.26		
Powell-Rouyn Gold Mines, Ltd.	39,436.24	55,334.50	
Charter-Quill Mines, Ltd.		271.00	
Organization expense (including managing director's shares)		51,260.40	
Administrative, general, and office expense		18,663.17	
Prospecting and exploration		54,661.29	
			$267,359.77
			$458,974.48
Liabilities and Capital			
Accounts payable			$4,374.48
Capital stock			
Authorized (5,000 shares $100 par value)		500,000.00	
Less unissued (454 shares $100 par value)		45,400.00	454,600.00
			$458,974.48

(a) The following contingencies are not reflected in the above statement: Contingent liability of $31,359.38 in connection with options now held by Continental Mines, Ltd.; also contingent asset to Noranda Mines, Ltd., of $45,000, on account of such options—neither contingent upon the other. In the event that such contingent liability becomes definite, certain mining claims now held by Continental Mines, Ltd., revert to Noranda Mines, Ltd.

The outstanding features of the work are the development by diamond drilling of copper-gold sulphide orebodies of commercial size and grade on the Horne Claim group, in Rouyn Township, Province of Quebec, and the discovery on the Chadbourne claim, two and a half miles southwest of the Horne, of a large deposit of the gold-quartz type which from surface examinations gives considerable promise.

No work was undertaken on the company's Ontario mining claims beyond that which was required to protect the properties, and only a few examinations were made of new prospects.

Ray Consolidated Copper Co.

The Ray Consolidated Copper Co. report for the first quarter of 1924 includes Chino's operations. The total net production of copper from all sources, including a small tonnage of crude ore shipped direct to smelters, was 32,392,026 lb., compared with 29,775,256 lb. for the preceding quarter and shown by months in the following tabulation:

First Quarter, 1924	Pounds	Fourth Quarter, 1923	Pounds
January	10,331,671	October	10,429,417
February	10,766,954	November	9,184,239
March	11,293,401	December	10,161,600
Totals	32,392,026		29,775,256
Average monthly production	10,797,342		9,925,085

The total ore milled from both mines was 1,433,600 tons dry weight, containing 1.54 per cent copper and corresponding to a daily average of 15,743 tons, compared with 14,673 tons for the previous quarter.

The cost per net pound of copper produced from all sources was 11.75c., compared to 11.80c. for the preceding quarter. These costs include all operating and general charges of every kind except depreciation and reserve for federal taxes. They also include the usual charges for retirement of prepaid mine development expense and take into account credits for miscellaneous income and the value of gold and silver recovered.

The financial results of operations for the quarter, as compared with those of the previous quarter, are as follows:

	First Quarter 1924	Fourth Quarter 1923
Operating profit from copper produced	$248,833.99	$131,852.53
Miscellaneous income, including value of precious metals	94,785.44	135,223.50
Totals	$343,619.43	$267,076.08

Earnings stated are based on an average carrying price for copper of 12.81c. compared with 12.69c. for the previous quarter.

At the Ray mines routine underground development, conducted principally in extending areas available for ore production, amounted to 10,758 ft. The construction of improved and enlarged facilities for handling ore at No. 2 shaft reached a point near completion at the end of the quarter. Betterments at the Ray mill are also progressing satisfactorily.

At the Chino mines eleven steam shovel crews removed 1,017,717 cu.yd. of material in place, of which 557,384 cu.yd. was waste stripping. Gradual application of new and improved mining equipment has brought about decided increases in both capacity and efficiency.

German Metal Markets Affected by Currency Situation

Special foreign correspondence

THE present state of affairs in the German metal trades generally reflects the unsteady economics which worry every business man and which may yield sounder developments with the putting into force of the Dawes reparation proposals. The metal trades are again stagnant; the activity in copper and lead that characterized the months of December, January, and February has turned again into decreasing employment and dwindling demands for metallic rawstuffs.

Toward the end of the last year, with the stabilization of the rentenmark currency, when the German mark turned out the best European currency, and next only to the dollar, Germans availed themselves of this singular opportunity to replenish empty stocks, the more so as many American producers of copper and lead, through the medium of their Berlin, Frankfort, and Hamburg representatives, were willing to grant credit facilities. Credits were given against drafts and acceptances of American banks, which showed confidence in the future restoration of German industries. But since March the Reichsbank and the chief banks of Germany have stiffened their credit policy with the view to bringing about a further deflation of commodity prices.

The unheard of tightness of the German money markets, where borrowers have to pay 60 or even 80 per cent a year (the official discount rate is only 10 per cent!) has made it impossible for metal consumers to work up the metals. Customers do not give back the outstanding obligations. The existent supply of metals is being liquidated to obtain funds to serve as a good source of interest profits. Copper, for instance, is on offer here at prices far below the ruling New York rates, chief holders being the Aron Hirsch, Halberstadt, and the Metallgesellschaft companies. They are now able to underbid the New York producers by 0.25c. a lb. of prompt electrolytic and 0.20c. for future delivery. Even at this rate the number of buyers is limited, and even such well-organized concerns as the Allgemeine Elektrizitäts-Gesellschaft, the Siemens-Schuckert, or Felten & Guillaume companies and a great many brass and wire works are buying from hand to mouth.

Great interest may be created across the Atlantic by the information that the big mining concern of the center of this country, the Mansfeld Copper Co., of Eisleben, the mining history of which goes back many centuries, and the (casting) copper product of which is of exceptional quality on account of its nickel ingredient, has decided to close down its mines and plants owing to the fact that copper produced inland can no longer compete with the "dumped" American electrolytically refined metal. The production costs for a pound of Mansfeld copper are said to exceed 14c., to which the exorbitant freight rates add additional charges, according to the point of destination. Having a productive capacity around 18,000 metric tons a year, numerous refineries for silver ore, rolling mills for copper, brass, aluminum, and lead, chemical plants, extensive coal and potash properties, and a teeming supply of labor of around 100,000 hands, the proposed shutdown would have a most depressing effect upon Germany. Therefore the Prussian Free State has agreed to grant a financial aid out of the pockets of taxpayers. But the help cannot continue for long, in view of the wretched state of Prussian finances and the competition of cheap American copper, which could hardly be kept out of Germany by customs duties, in view of the fact that many important industries here depend on foreign copper and it is necessary to export to bring in the wherewithal for reparation payments.

Another factor which reduced the purchasing power of dealers in copper is the failure of the recent speculation in French francs by acquiring lead and zinc for future delivery against francs (for zinc against Belgian currency). Gambling of this sort was rampant throughout the country, and involved a great number of new firms and of old-established ones. But whereas the latter succeeded in covering operations by hastily selling metals in London, thus causing a sharp drop in the London market, at least 10 per cent of the middle-sized trading firms are now eliminated from ordinary metal business. The losses experienced are such that special funds had to be put at the disposal of the trade by banks. It is hoped by old-established companies that these events will do away with the hypertrophy of metal trading and jobbing in Germany, which has been the direct result of the inflation period. Whereas the total output of metals is only about the third part of the size of pre-war times, Germany has now at least 100 metal-selling houses.

A period of readjustment appears to have come. The monopoly of a small number of producers of zinc who are being kept together by the Kattowitz Syndicate is being battered by Belgian competition. There are grand projects afloat to create a huge vertical combination or trust which shall comprise ore miners and especially finished-material producers. The name of the combination is to be Metal-Bund. Negotiations have been carried thus far by the western union of rolling mills, but, unluckily, reconciling the state aluminum producers with the project meets little response, although they have recently been operating as a limited company under state control. But the works, the capacity of which is to be increased greatly by the Bavarian Innwerk, are always sold out, and are, moreover, said to entertain an understanding with the Neuhausen (Switzerland) and British aluminum producers with regard to prices, and there is a rumor that it aims to come to an agreement with the Aluminum Company of America.

Mining Dividends for May Register Substantial Increase

The following dividends were paid by mining and metallurgical companies in May:

Companies in the United States	Situation	Per Share	Total
American Smelting & Refining	Various	$1.25 Q	$762,475
Arizona Copper, c	Ariz.	1s. SA	£75,995
Chief Consolidated, s. l	Utah	$0.10 Q	$89,221
Colorado Fuel & Iron pfd	Various	2.00 Q	40,000
Copper Range, c	Mich.	1.00 A	394,422
General Development	Various	0.25 Q	30,000
Homestake Mining, g	S. D.	0.50 M	125,580
International Nickel pfd., n. c	W. Va., Ont.	1.50 Q	135,689
Miami Copper	Ariz.	0.50 Q	373,557
New Cornelia Copper	Ariz.	0.25	450,000
New Jersey Zinc	Various	2.00 Q	909,328
St. Mary's Mineral Land, c	Mich.	3.00 K	160,000
U. S. Steel pfd	Various	1.75 Q	6,304,919
United Verde Extension, c	Ariz.	0.50 Q	525,000
Companies in other countries:			
Amparo Mining, g.s	Jalisco	0.03 Q	60,000
Aramayo en Bolivie, s. t. b. c	Bolivia	1.25 Q	
		Swiss francs	750,000
Cerro de Pasco, c. s	Peru	$1.00 Q	$898,230
Coniagas, s	Ont.	0.125 SA	100,000
Hollinger Consolidated Gold	Ont.	0.05 4 wks.	246,000
Lake Shore, g	Ont.	0.02 Q	40,000
Lucky Tiger-Combination, g	Sonora	0.07 M	50,074
McIntyre-Porcupine, g	Ont.	0.25 Q	191,500
Ouro Preto Gold	Brazil	1s. 6d.	£2,957
Ouro Preto Gold pfd	Brazil	1s. 6d.	3,199
Silversmith Mines, s.l.z	B. C.	$0.01 K	$25,000
Total dollars			$11,910,995

c, copper; s, silver; g, gold; l, lead; n, nickel; t, tin; b, bismuth; z, zinc; Q, quarterly M, monthly; SA, semi-annually; A, annually; K, irregularly.

The total amount of dividends paid in May was greater than that for either of the preceding quarters ending in November or February. Chief Consolidated resumed its regular quarterly dividend, which was interrupted in February to pay for its new mill. Copper Range seems to have made its $1 rate an annual affair. New Cornelia Copper paid its first dividend since August, 1923, and at the old rate. St. Mary's Mineral Land, which pays irregularly, made a liberal distribution of $3, compared with $1 in December, indicating that the copper industry in Michigan is not run entirely without profit. In fact, none of the regular dividend payers passed their dividends, and only two reduced their distributions, these being Silversmith, from 2 to 1c., and United Verde Extension, from $1 to 50c.

Mining Stocks

Week Ended May 24, 1924

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Alaska-Br. Col.	N. Y. Curb	*10	*10	*10		
Anaconda	New York	30⅛	28½	30⅛	De.15, Ja.21, Q	0.75
Arcadian Consol.	Boston	1	1	1		
Ariz. Com'l	Boston	8½	8	8½	Ja.15, Ja.31	0.50
Calaveras	N. Y. Curb			1⅜		
Calumet & Arizona	Boston	45¾	44¾	45¾	Jn. 6, Ju. 23, Q	0.50
Cal. & Hecla (New)	Boston	15	13¼	15	My. 31, Jn. 16	0.50
Canario Copper	N. Y. Curb	2 3/16	2 1/16	2⅛		
Cerro de Pasco	New York	45¼	43⅜	44⅞	Ap. 17, My. 1	1.00
Chile Copper	New York	28	27⅜	27⅞	Jn.2, Jn.30, Q	0.62½
Chino	New York	16	15⅝	16	Sept., 1920,	0.37½
Con. Coppermines	N. Y. Curb	2 1/16	2	2 1/16		
Copper Range	Boston	20¼	19⅜	20¼	May, 1923	1.00
Crystal Copper	Boston Curb	58	55	56		
Davis-Daly	Boston	*48	*45	*45	Mar., 1920	0.25
East Butte	Boston	4¼	4	4	Dec., 1919	0.50
First National	Boston Curb			27	Feb., 1919,	0.15
Franklin	Boston	*50	*50	*50		
Gadsden Copper	Boston Curb	*40	*40	*40		
Granby Consol.	New York	13⅞	13¼	13½	May, 1919	1.25
Greene-Cananea	New York	10	10	10	Nov., 1920	0.50
Hancock	Boston	1	1	1		
Howe Sound	N. Y. Curb	2⅜	2⅜	2⅜	Ap.1, Ap.15, Q	0.05
Inspiration Consol.	New York	23½	22⅝	23⅜	De.20, Ja.7, Q	0.50
Iron Cap	Boston Curb			2½	May, 1923	0.15
Isle Royale	Boston	13⅜	13⅛	13⅜	Se. 1, Se. 15,	0.50
Jerome Verde Dev.	N. Y. Curb	1 1/16	1	1		
Jib Consol	N. Y. Curb	*34	*20	*25		
Kennecott	New York	38⅞	37⅜	38⅝	Jn.6, Jy. 1, Q	0.75
Keweenaw	Boston	*75	*75	*75		
Lake Copper	Boston	1½	1¼	1¼		
Magma Copper	New York	29⅜	28½	29	Jan., 1919	0.50
Mason Valley	N. Y. Curb			1½		
Mass Consolidated	Boston	†60			Nov., 1917	1.00
Miami Copper	New York	20	20	20	My 1, My.15, Q	0.50
Mohawk	Boston	27	26	26½	Se. 22, Oc. 13,	1.00
Mother Lode Con.	New York	8⅛	6	7¼	De.14, De.31	0.50
Nevada Consol.	New York	13	12⅞	13	Sept., 1920,	0.25
New Cornelia	Boston	18½	17⅞	18	My.9, My.26,	0.25
New Dominion	N. Y. Curb			2⅜		
North Butte	Boston	2⅛	2⅛	2⅛	Oct., 1918,	0.25
Ohio Copper	N. Y. Curb	*96	*80	*90		
Old Dominion	Boston	†17½			Dec., 1918	1.00
Phelps Dodge	Open Mar.	†110	†100		Mc.24, Ap.2 Q	1.00
Quincy	Boston	16	15	15½	Mar., 1920	1.00
Ray Consolidated	New York	9¾	9½	9¾	Dec., 1920	0.25
Ray Hercules	N. Y. Curb			*14		
St. Mary's Min. Ld.	Boston	28	27½	28	Ap.22, My.20	3.00
Seneca Copper	New York	1	7/8	7/8		
Shannon	Boston	*35	*35	*35	Nov., 1917	0.25
Shattuck Arizona	New York	4½	4½	4½	Jan., 1920	0.25
Superior & Boston	Boston	*50	*50	*50		
Tenn. C. & C. cfs.	New York	7⅛	7	7	De.31, Ja.15, Q	0.25
Utah Copper	New York	68	66½	67⅞	Mc.14, Mc.31, Q	1.00
Utah Metal & T.	Boston	*30	*30	*30	Dec., 1917	0.30
Victoria	Boston	†60				
Walker Mining	N. Y. Curb	2⅞	2⅞	2⅞		
Winona	Boston	*15	*15	*15		
NICKEL-COPPER						
Internat. Nickel	New York	11⅞	11⅛	11⅞	Mar., 1919	0.50
Internat. Nickel pfd.	New York	76	76	76	Ap.17, My.1, Q	1.50
LEAD						
Carnegie Lead & Zinc	Pittsburgh	2⅜	2⅛	2⅛		
National Lead	New York	132¼	127½	132¾	Jn.13, Jn.30, Q	2.00
National Lead pfd.	New York	111½	111⅛	111⅛	My. 23, Ju. 14, Q	1.75
St. Joseph Lead	New York	24	24	24	Mc. 20, 1924	0.50
ZINC						
Am. Z. L. & S.	New York	7⅛	7	7	May, 1920	1.00
Am. Z. L. & S. pfd.	New York	26	26	26	Nov., 1920	1.50
Butte C. & Z.	New York	4⅛	4⅛	4⅛	Mar., 1923	0.50
Butte & Superior	New York	14½	14½	14½	Je.15, Je. 30, Q	0.50
Callahan Zn-Ld.	New York	3½	3½	3½	Dec., 1920	0.50
New Jersey Zn.	N. Y. Curb	140	139	139	May 10, 1924	2.00
United Zinc	N. Y. Curb			*25		
Yellow Pine	Los Angeles	71¼	67½	71½	Mar., 1924	0.04
SILVER						
Alvarado	N. Y. Curb			1		
Beaver Consol.	Toronto	*18½	*17½	*17½	May, 1920	0.03
Castle-Trethewey	Toronto	†*66	†*61½	*59½		
Coniagas	Toronto			1.90	Ap.20, My.1	0.02½
Crown Reserve	Toronto	*53½	*50	*51½	Jan., 1917	0.05
Keeley	Toronto	2.18	2.14	2.14		
Kerr Lake	N. Y. Curb			1⅝	Ap.1, Ap.15, Q	0.12
La Rose	Toronto	*11	*11	*11	Apr., 1922	0.10½
Lorrain Trout Lake	Toronto	1.35	1.30	1.32		
McKinley-Dar.-Sav.	Toronto	*11¾	*11½	*11½	Oct., 1920	0.03
Mining Corp. Can.	Toronto	3.05	2.95	3.00	Sept., 1919	0.12½
Nipissing	N. Y. Curb	6⅛	5⅞	6	Mc.1, Ap.21, Q	0.03½
Ontario Silver	New York			6	Jan., 1919	0.50
Temiskaming	Toronto	*22	*21	*21	Jan., 1920	0.40
GOLD						
Alaska Gold	New York	⅛	⅛	⅛		
Alaska Juneau	New York	1⅞	1¾	1¾		
Argonaut	Toronto	*44	*42	*42		
Carson Hill	Boston	1¼	1¼	1¼		
Cresson Consol. G.	N. Y. Curb	3 7/16	3⅜	3 7/16	Mc.3, Ap.10, Q	0.10
Dome Mines	New York	16	15¾	15¾	Mc.26, Ap.21, Q	0.50
Golden Cycle	Colo. Springs				My.31, Jn.10 Q	0.03
Hollinger Consol.	Toronto	†12.75			My. 1, My. 19	0.05
Homestake Mining	New York	49½	48¾	48¾	My.10, My.26,	.50
Kirkland Lake	Toronto	*20	*20	*20		
Lake Shore	Toronto	3.71	3.65	3.67	My.2, My.15	0.02
McIntyre-Porcupine	New York	15¼	15	15	Ap. 1, My. 1,	0.25
Newray	Toronto	*26	*26	*26		
Portland	Colo. Springs				Oct., 1920	0.01
Teck-Hughes	Toronto	1.16	1.13	1.13		
Tom Reed	Los Angeles	36½	35	35½	Dec., '1919	0.02
Tough-Oakes	Toronto	†*64	†*63	62½		
United Eastern	N. Y. Curb	*61	*59	*61	Ap 10, Ap.28, Q	0.10
Vipond Cons.	Toronto	1.04	1.02	1.02		
Wright-Hargreaves	Toronto	3.00	2.95	3.00	Mc.15, Ap. 1, Q	0.02½
GOLD AND SILVER						
Black Oak	N. Y. Curb	*73	*68	*73		
Con. Cortez	N. Y. Curb	*38	*26	*38		
Con. Virginia	San Francisco	5¼	4½	5		
Continental Mines	N. Y. Curb			2½		
Dolores Esperanza	N. Y. Curb			*50	Jy. 1, Jy. 10 Q	0.05
Premier Gold	N. Y. Curb	2	2	2	Mc.28, Ap.5	0.08
Tonopah Belmont	N. Y. Curb	*58	*58	*58	Apr., 1923	0.05
Tonopah Divide	N. Y. Curb	*21	*17	*21	Se.22, Oc. 10	0.10
Tonopah Extension	N. Y. Curb	2⅜	2 1/16	2⅛	Jn. 10, Jy. 1	0.05
Tonopah Mining	N. Y. Curb	1⅜	1	1⅜	Ap. 6, Ap. 21	0.07½
Unity Gold	N. Y. Curb	1¼	1	1¼		
West End Consol.	N. Y. Curb	*50	*48	*50	Mar., 1923	0.05
Yukon Gold	N. Y. Curb	*55	*55	*55	June, 1918	0.02
SILVER-LEAD						
Ahumada	Boston Curb	5⅞	5⅜	5⅞	Mc., Ap. 2, X	0.15
Bingham Mines	Boston	14¼	14¼	14¼	Sept., 1919	0.25
Cardiff M. & M.	Salt Lake	*85	*85	*85	Dec., 1920	0.15
Chief Consol.	Boston Curb	3¼	3⅛	3 7/16	Ap.19, My.1, Q	0.10
Columbus Rexall	Salt Lake	24	24	24	Aug., 1922	0.03
Consol. M. & S.	Montrea !	40	39¼	39¼	Oct., 1920	0.62½
Daly Mining	Salt Lake			205	July, 1920	0.10
Erupcion	Boston Curb	2⅛	2 1/16	2⅛	Mc. 15, Ap.2, X	0.15
Federal M. & S.	New York			8½	Jan., 1909	1.50
Federal M. & S. pfd.	New York	44	43	44	My.26, Jn.15, Q	1.75
Florence Silver	Spokane	12⅜	11	12⅜	Apr., 1919, QX	0.01
Hecla Mining	N. Y. Curb	8¼	8⅛	8¼	My.15, Jn.15,	0.25
Iron Blossom Con.	N. Y. Curb			*26	Oct., 1923	0.02
Marsh Mines	N. Y. Curb	*7	*7	*7	June, 1921	0.02½
Park City	Salt Lake			4.00	Mar., 1924	0.15
Park Utah	N. Y. Curb			3½	Mc.15, Ap.1	0.15
Prince Consol.	Salt Lake	*7	*3½	*3½	Nov., 1917	0.02
Silver King	N. Y. Curb	*90	*60	*60	Ap. 1, X	0.30
Silversmith	Spokane	40½	40	40	My. 1, My. 10	0.01
Tamarack-Custer	Spokane	1.75	1.65	1.65	Se.30, Oc. 1, K	0.02
Tintic Standard	Salt Lake	4.20	4.20	4.20	Mar. 25, 24, QX	0.15
Utah-Apex	Boston	2 7/16	2¼	2⅜	June, 1923,	0.50
IRON						
Bethlehem Steel	New York	49½	46	48¾	Jn.1, Jy.1, Q	1.25
Char. Iron	Detroit	1/16	1/16	1/16		
Char. Iron pfd.	Detroit			1		
Colorado Fuel & Iron	New York	41⅞	38	40½	My.10, My.26, Q	2.00
Col. Fuel & Iron pfd.	New York			102	Feb., 1923	2.00
Gt. North'n Iron Ore	New York	27	26	26⅞	De.10, De.27	2.00
Inland Steel	N. Y. Curb			46	My.15, Jn. 1 Q	0.62½
Mesabi Iron	N. Y. Curb	2½	2	2½		
Replogle Steel	New York	8½	8	8		
Republic I. & S.	New York	45¾	43½	45½	May, 1921	1.50
Republic I. & S. pfd.	New York	88	85	88	Jn.14, Jy.1, Q	1.75
Sloss-Sheffield S. & I.	New York	56	52	56	Jn.6, Jn.20, Q	1.50
Sloss-Shef. S. & I. pfd.	New York	82	82	82	Jn.18, Jy.2, Q	1.75
U. S. Steel	New York	98	95	97⅞	Jn.1, Jn.28 QX	1.75
U. S. Steel pfd.	New York	119¼	119	119½	My.6, My.29, Q	1.75
Virginia I. C. & C.	New York	41	36	37½	De.15, Ja. 2	1.50
Virginia I.C. & C. pfd.	New York	78	74	74	Jn.17, Jy.1	2.50
VANADIUM						
Vanadium Corp.	New York	22¾	21½	22½	Jan., 1921	1.00
ARSENIC						
Western Utah Copper	N. Y. Curb	*25	*17	*17		
ASBESTOS						
Asbestos Corp.	Montreal	24½	24	24½	Se.29, Oc.15 Q	1.00
Asbestos Corp. pfd.	Montreal			55	Ap.1, Ap.15, Q	1.50
SULPHUR						
Freeport Texas	New York	9	8½	9	Nov., 1919,	1.00
Texas Gulf	New York	61½	59¾	61½	My.31, Jn.14 QX	1.75
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	3⅜	3⅜	3⅜		
MINING, SMELTING AND REFINING						
Amer. Metal	New York	39½	39⅛	39½	My.20, Jn.1, Q	0.75
Amer. Metal pfd.	New York			109½	My.20, Jn.1, Q	1.75
Amer. Sm. & Ref.	New York	62⅝	59⅜	62½	Ap. 11, My. 1, Q	1.25
Amer. Sm. & Ref. pfd.	New York	100	99¼	100	My. 9, Jn. 1.	1.75
U. S. Sm. R. & M.	New York	20¼	20	20¼	Jan., 1921,	0.50
U. S. Sm. R. & M. pfd.	New York			40	Apr., 1924, Q	0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Movsey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Colorado Springs, Colorado Springs Stock Exchange.